

# Johns - Manville Products



## General Catalogue

DS Series 2

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**General Catalogue  
of  
J-M Products**

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*Building*  
**MATERIALS**

*Industrial*  
**PRODUCTS**





# General Data Sheets

on

## Johns-Manville Products



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### JOHNS-MANVILLE INTERNATIONAL CORPORATION

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OFFICES IN FOREIGN COUNTRIES



## Johns-Manville Data Sheets

The Johns-Manville data sheet system is intended to supply accurate and detailed information pertaining to Johns-Manville products and their uses. Its purpose is fulfilled if those having need of this data find it readily available to them in convenient form.

The 2000 odd pages that comprise the data sheet system are made up as various collated sets, the most complete of which is the data sheet master set (three large, expanding volumes; older sets, seven smaller volumes). This contains all of the current sheets and serves as a loose-leaf encyclopedia of information on J-M products and their application for use within the company *only*. Over 115 data sheet master sets are maintained throughout the Johns-Manville organization. New and revised sheets are distributed periodically in order to keep these sets accurate and up-to-date as possible.

More convenient data sheet books for field use are the sales manuals and general catalogues, which contain roughly 500 of the more useful master set pages. Approximately 1000 sales manuals are in use throughout the company, while several times that number of customers have J-M General Catalogues.

The commodity index below offers ready reference to

information dealing with the various J-M products. A more detailed classification appears in the indices following each tab in this book.

When information regarding specific products or their application is desired in book form, there are available over 170 standard and special collations which are identified by DS Series numbers. In order to include the most recent data, these books are made up only when needed for immediate use.

However, the primary purpose of the data sheet system is to provide a concentrated source of information on J-M products and their application for use within the company. In no sense are the various DS Series (8½" x 11" loose sheets "side-stapled" in a practical cover) to be compared to the sales promotion type of brochure, which is not only prepared specifically for sales use but is manufactured with the more durable "saddle-stitching" or staples through the center of the collated 11" x 17" signatures.

All data sheets in bound form, as well as individual pages or special collations, are published by the Technical Data Section of Johns-Manville and may be obtained through regular company distribution channels.

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## Johns-Manville



*At Manville, New Jersey, is located one of the two principal Johns-Manville plants. This plant includes an administration building, power house, thirteen manufacturing buildings, and five research buildings*

The Johns-Manville Corporation, and its subsidiaries, is engaged principally in the business of mining, manufacturing and selling materials for the control of heat and cold, sound and motion; and for furnishing protection in industrial plants, commercial buildings, public buildings and residences against the destructive effects of fire, weather, and wear.

Among the principal products are insulating materials for industrial, commercial and residential service, roofing and a large variety of building materials, friction materials for automotive and general industrial purposes, acoustical materials and sound-deadening products, packings and refractory cements, waterproofing materials, diatomaceous silica products for filtration and inert fillers, asbestos-cement pipe for water and sewer distribution systems and for various industrial uses, a wide range of products for the electrical industry, and asbestos textiles and fibers.

Following is a brief summary of the history and development of the company and a correspondingly brief outline of its present organization.

### History and Development

The business which is now Johns-Manville originated in 1858 when H. W. Johns, roofing manufacturer and asbestos pioneer, started out as a manufacturer and jobber in New York City. His first business was the production of a roofing made from rag felt and coal tar. Since the coating for finishing the roofs was black and his customers demanded other colors, he was led to enter the paint business as a side line. Although the H. W. Johns Company was started in 1858, very little progress was made until the 1870's because of conditions brought about by the Civil War.

Some of the earlier experiments by Mr. Johns to determine the possibilities of asbestos were conducted in



the face of odds unknown to modern experimentation. For instance, his effort to produce a fireproof roofing from saturated wood felt, burlap, manila paper, asphalt and asbestos, was made with equipment consisting of an oil stove, a tea kettle with a flattened spout and an ordinary clothes wringer. In this process, the felt, burlap and paper were guided into the clothes wringer, while asphalt was poured from the kettle upon the intermediate layers. Then the upper surface of the combined layers was coated with the asphalt and a layer of asbestos fibre embedded. Finally the sheet was run through the wringer again to fix the asbestos firmly to the surface.

In 1886 there were four departments in the H. W. Johns Manufacturing Company: Asbestos Fiberizing and Textiles, Paints, Roofing, and Insulation. In 1892 several competitive companies were merged and the concern carried on under the original name. Mr. Johns died in 1898, and was succeeded shortly thereafter by H. W. Johns, Jr.

Charles B. Manville, the founder of the other branch of the Johns-Manville organization, was a pioneer in several fields during one of the most interesting and vital periods of the country's history. Included among his early activities were the operation of a successful general merchandising store in Wisconsin and six years experience in gold mining and ranching in South

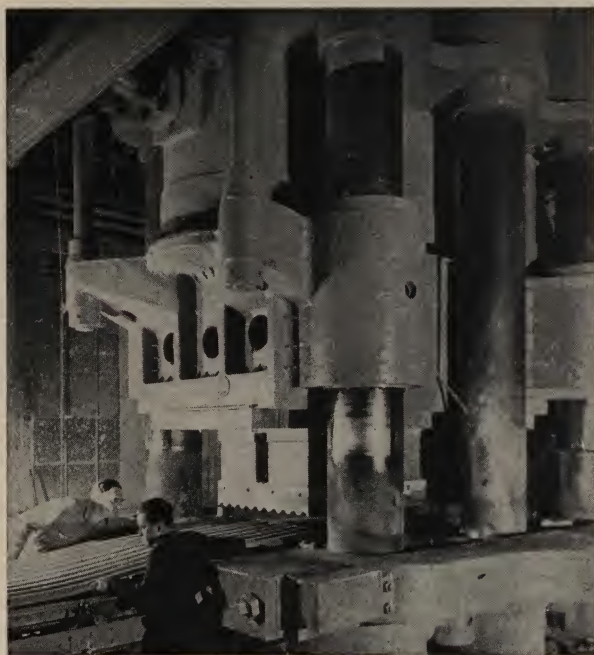


*The above woodcut, entitled the "Asbestos Works of the H. W. Johns Manufacturing Company," appeared in the February 26, 1881, issue of Scientific American. The scenes portray the Brooklyn factory and early manufacturing methods*

Dakota after the discovery of gold in that state in 1876. Recognizing the trend of the United States from an agricultural to an industrial nation, he moved to Milwaukee where, in 1886, he and his three sons, Thomas F., Charles R., and H. Edward, organized the Manville Covering Company.

The early days of the Manville Company were largely occupied in determining by constant experimentation the best materials for covering boilers, steam piping, etc. Mixtures of paper pulp and blue clay, common in the vicinity of Milwaukee, were tried on the neighbors furnaces. Partial success resulted but expansion and contraction of the metal surfaces tended to dislodge the insulation. By adding wool felt shoddy as a binder in the clay, instead of paper pulp, failure from contraction and expansion was considerably lessened. This newer product became widely known as Manville Sheep's Wool Cement. It proved to be a fair insulation and more practical than the original mixture, but it gave off a disagreeable odor until thoroughly dried. There are many stories told of old-time Manville Covering men applying the material to pipes and boilers and then rushing out to escape the malodorous scent.

While the business expanded rapidly from this point, the company did not include insulations for the higher temperature ranges. Since production methods in industry were rapidly changing and constantly increasing steam pressures were being employed, corre-



*This huge hydraulic press now used in the manufacture of corrugated Transite sheets is in vivid contrast to the early production methods shown in the above woodcut*



sponding demands for high-pressure insulations resulted. This led to the arrangement under which the Manville Covering Company took over operation of the H. W. Johns Manufacturing Company's Chicago branch, which was experienced in handling the rapidly developing asbestos products for high-temperature insulations. Then, in 1901, the two firms merged and the business was continued as a corporation under the name H. W. Johns-Manville Company.

As a result of a change in 1920, the name became Johns-Manville, Inc. Then, late in 1926, a further reorganization took place and the company has been called the Johns-Manville Corporation since Jan. 1, 1927.

The earlier years of the company's history were devoted largely to developing commercial products manufactured from asbestos. From these years of experiment there evolved a period between 1900 and 1915 where the major problem was one of finding sufficient ways and means to provide for the building of additional plants made necessary by the rapid growth of the company.

Then came a period in which production was the prime objective; then one of readjustment and adaptation to meet the changing needs of industry; then a period of war-time production and now a return to competitive enterprise.

## Research and Development

This continuous adaptability of the company and the ready recognition and applications of modern merchandising, marketing and distribution methods have made Johns-Manville outstanding in the field of production and distribution. And equally important, a broad visualization of the future is constantly maintained through the agency of continual scientific research.

Advancing from the earliest research equipment the clothes wringer, tea kettle and oil stove, the present research center of the company is the finest in its particular field. Here, an endless sequence of new processes and materials is brought forth and constant effort is made toward the better use of old materials. It is research of this nature which determines customers' needs even before they themselves become conscious of such requirements.

At each plant the Industrial Engineering Department functions through trained industrial engineers to assist the production organization in reducing manufacturing costs and solving production problems. This department is concerned with improvement in manufacturing methods, reduction of waste and finding lower cost raw materials at no sacrifice in quality. Prominent economies effected by this group result from the continual improvement of old methods and



*The Johns-Manville Research Center at Manville, New Jersey*



development of new methods, many of which are outstanding because they completely change the process. Others, just as important, constitute the sum of many small improvements in the manufacture of a product.

Both research and the industrial engineering department have established enviable records in the production of better goods at lower prices.

### Operating Organization

The present operating organization of Johns-Manville consists of seven operating divisions as follows:

1. Industrial Products Division.
2. Building Products Division.
3. Celite Division.
4. Asbestos Fibre Division.
5. Canadian Products Division.
6. International Division.
7. Dutch Brand Division.

As new businesses are developed or acquired, and as the company grows, additional divisions will be created when needed. Each of the seven operating divisions is responsible for the production and sale of products under its jurisdiction.

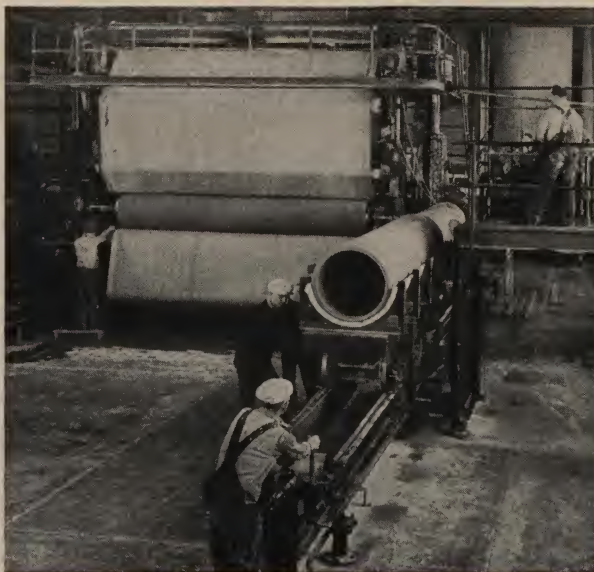
#### Industrial Products Division:

The Industrial Products Division is responsible for the production and sale in the United States of all industrial insulations, packings, refractories, electrical products, friction materials. Transite pipe, and services related thereto.

In some parts of the United States where this operating division cannot sell its products economically, they will be sold by the Building Products Division. Sales distribution is made in part directly to industrial users and in part through plumbing and mill supply houses and applying contractors who stock and install the materials.

In some areas, the operating division maintains its own contracting organizations for the installation of certain heat-insulation materials. The products of this operating division are also sold directly to many manufacturing companies for incorporation into their particular products.

The Transportation Sales Organization, a unit of the Industrial Products Division, embraces practically all the company's products. Sales are made directly to the various types of railroads and railways, bus lines and airways, locomotive and car builders, as well as manu-



*Typical of modern methods employed by Johns-Manville are the giant machines used in the manufacture of Transite Pipe. This view shows the removal of a section of the completed pipe, which has been built-up on a steel mandrel*

facturers of railway appliances. Sales to the automotive industry, consisting of brake linings and clutch facings, packings, friction tape, insulating and sound-deadening materials, are handled through two principal markets. The replacement market, selling to the jobbing trade, and the equipment market in which products are sold directly to both automobile and accessory manufacturers.

#### Building Products Division:

The Building Products Division is responsible for the production and sale in the United States of products and services to be used in building construction, including insulation of buildings but excluding insulation of pipes and equipment. In some parts of the United States this operating division will sell the products of the Industrial Products Division where they cannot economically do so themselves.

The various materials handled by the Building Products Division include built-up and ready-to-lay roofing, roofing and siding shingles, insulating board products, asbestos-cement sheet products, water-proofing felts and accessories, asphalt bridge planking, home insulation in batt and granular forms, decorative and industrial flooring, acoustical products and Transite movable partitions.

These products are classified as Dealer Building Materials, distributed to lumber and building supply



dealers; Industrial or Contract Building Materials, sold directly to large industrial concerns or through applying contractors; and Spintex Home Insulation (applied by the pneumatic method) sold to applying contractors.

#### *Celite Division:*

The Celite Division is responsible for production from the Lompoc Plant and for the sale of the products thereof (other than for insulation) in the United States.

Sold under the name "Celite," the products made from diatomaceous silica are generally classified according to usage, as follows: Celite filter aids serving for the filtration and clarification of fats, oils, sugars and miscellaneous liquids in various manufacturing processes; and Celite mineral powders used for inert fillers, mild abrasives, or external pigments in such products as paints, paper, asphalts, plastics, catalyst carriers, polishes, cleaners, etc.

These various Celite products are sold directly to industrial customers, such as sugar and glucose refineries, paint and varnish manufacturers, chemical plants, cider and vinegar mills, distilleries, wineries and breweries.

#### *Asbestos Fibre Division:*

The Asbestos Fibre Division is responsible for production from the Asbestos, Quebec, mine; for the purchase of fibre from other sources; for the sale of fibre in the United States and Canada; and for the supply of fibre to divisions which consume or sell it.

#### *Canadian Products Division:*

The Canadian Products Division is responsible for the production and sale of all manufactured products and services in Canada.

#### *International Division:*

The International Division is responsible for conduct of the company's business elsewhere than in the United States and Canada.

#### *Dutch Brand Division:*

The Dutch Brand Division is responsible for the production and sale in the United States and elsewhere of products containing crude and synthetic rubber, ranging from liquid cements to molded parts, sponge rubber and coated materials, including a wide variety of commercial and industrial tapes and allied materials.

#### **Plants and Mines**

The functioning of the manufacturing plants and mines is comparable in modern and progressive methods to J-M sales and research.

**Quality Control:** At each plant the Quality Control Department, through trained chemists and engineers, subject raw materials and products in process to rigid control at various stages of manufacture. Also, constant inspection for uniformity and adherence to standards assures consistent high-quality production.

A brief tabular description of the manufacturing plants and the mines of Johns-Manville follows:



*A section of the Control laboratory at the Manville plant*



### Johns-Manville Manufacturing Plants

Name of Plant and Location	Name of Administering Division	Approx. Sq Ft Floor Area	Principal Products Manufactured
Alexandria, Indiana	Building Products	213,500	Mineral wool and allied products such as home insulation, Airacoustic, Zerolite and Rock Cork.
Asbestos, Quebec	Canadian Products	267,000	Asbestos paper and millboard, asbestos textiles, packings, heat-insulation materials, asphalt and asbestos-cement roofing and shingles, and friction materials.
Billerica, Mass.	Industrial Products	188,000	Marinite products.
Chicago, Illinois	Dutch Brand	140,000	Friction and rubber insulating tapes, Plastix electrical tape, industrial adhesive tapes, industrial and household masking tapes, automotive rubber products, rubber cements, mechanical rubber goods molded to specifications, rubberized fabrics, sponge rubber, Dec-O-Tape, sandblast stencil and filler cement.
Fort Worth, Texas	Building Products	82,250	Asphalt roofing and shingles.
Jarratt, Virginia	Building Products	259,000	Wood fiber insulating board and allied products, such as ceiling panels, wall plank, insulating lath, and Weathertite sheathing.
Los Angeles, California	Building Products	68,500	Asphalt roofing and shingles.
Manville, New Jersey	Industrial and Building Products	1,880,000	Practically all J-M products with the major exceptions of insulating board, Marinite, Sanacoustic and moulded linings. Products designed for the control of heat and cold, sound and motion, and protection against fire, weather and wear. Such as asbestos textiles, packings, friction materials, insulating materials, asbestos paper, asphalt and asbestos-cement roofings, floorings, Transite (asbestos-cement) roofing and siding, mineral wool insulations, Transite (asbestos-cement) pipe, Transite electrical conduit, and sound-absorption materials.
Marrero, Louisiana	Building and Industrial Products	339,000	Transite (asbestos-cement) pipe, asbestos-cement shingles, asphalt roofing and shingles, roofing cements and putties.
Moll, Belgium	International	—	Asbestos-cement siding, roofing products, and miscellaneous asbestos-cement products.
Nashua, N. Hampshire	Industrial Products	268,000	Asbestos-cement products such as Transite, Asbestos Ebony, Flexboard and Marine Veneer.
Natchez, Miss.	Building Products	355,000	Wood fiber insulating board and allied products, such as ceiling panels, wall plank, insulating lath, and Weathertite sheathing.
New Brunswick, New Jersey	Industrial Products	49,000	A diversified line of metal and metal-containing gaskets for industrial requirements.
Pittsburg, California	Building Products	257,000	Asbestos and rag felt paper, insulating cements, asphalt and asbestos shingles, roofings, roofing cements and putties.
Redwood City, California	Industrial Products	95,000	High temperature insulations (Superex and 85% Magnesite).
Richmond, Indiana	Industrial Products	147,000	Mineral-wool insulations for equipment such as automobile bodies, refrigerators, stoves, airplane cabins, and railroad cars.
Tilton, N. Hampshire	Industrial Products	34,500	Asbestos paper for electrical insulations such as Quinterra and Quinorgo.
Toronto, Ontario	Canadian Products	233,100	Transite (asbestos-cement) pipe insulating and refractory cements, mineral wool insulations for industrial and home use.
Watson, California	Industrial and Bldg. Prod.	275,000	Transite (asbestos-cement) pipe and mineral wool insulations for industrial and home use.
Waukegan, Illinois	Industrial and Building Products	1,610,000	As with Manville plant, practically all J-M products with the major exceptions of textiles, insulating board, and Marinite. Waukegan has the distinction of being the home of the moulded brake lining—a J-M development which made possible the internal brake.
Zelienople, Pennsylvania	Industrial Products	116,400	Insulating fire brick and refractory cement for temperatures to 3000 F.



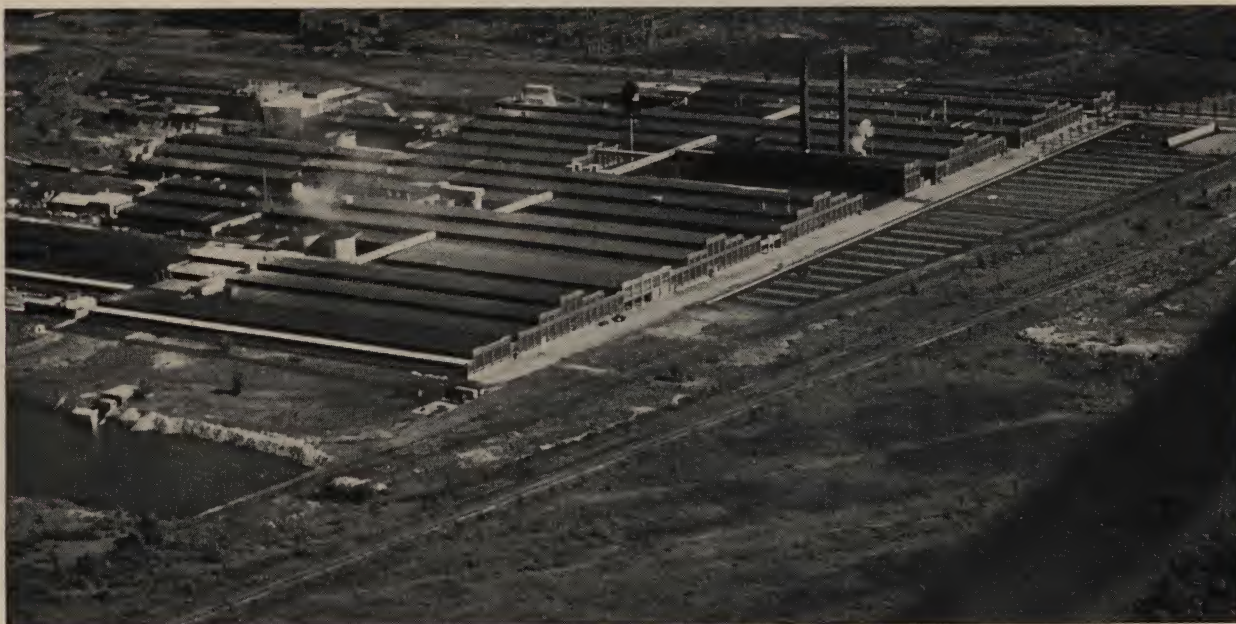
*Johns-Manville Mines*

Name of Mine and Location	Name of Administering Division	Description, Operation and Production
Jeffrey, Asbestos, Quebec	Asbestos Fibre	Asbestos mining and milling operations are conducted. The mining operation is carried on by power shovels in an open pit, and by electric locomotives operating on company-owned, standard-gauge railroad with the necessary rolling equipment. Underground mining is also carried on, using the block-caving method, and will ultimately replace open pit mining. The average yearly rate of production of asbestos fiber (1941-1954, inclusive) was approximately 330,000 tons. The fiber is used in the manufacture of products such as textiles, clothing, electrical insulations, asbestos-cement products, cements and putties, moulded plastics and brake linings, floorings and others.
Lompoc, Lompoc, California	Celite	Diatomaceous earth quarries and mills for the production of diatomaceous earth filter-aids and mineral fillers (Celite), and insulating materials (Sil-O-Cel). Modern crushing and blending equipment and other special apparatus for the production of improved filtration and filler materials are provided. Operations include both open pit quarries and stope mining underground. The average yearly rate of production of processed ore (1941-1954, inclusive) was approximately 132,000 tons. Much of the material is moved from the different quarries down to the mills by an underground electrically operated railroad which extends about 1½ miles under the hills.
Munro, Munro Township, Ontario	Asbestos Fibre	An asbestos deposit with qualities that make it superior for certain products to any other grade produced by Johns-Manville. This mine and mill started production in the summer of 1950. The average yearly rate of production of asbestos fiber (1951-1954) was approximately 23,500 tons.

**Up-to-Date Facilities**

Ample resources, modern mining operations, strategic plant locations and a widely spread distributing organization trained in the solution of consumer problems all contribute to Johns-Manville high standards of service. Regulated production, standardization,

research and rigid product control assure maintained quality, year-in and year-out. Johns-Manville as an institution offers more than a source for the purchase of asbestos and kindred materials. It stands upon its tradition in fairly serving the public with the best that industry can supply.



*One of the two principal plants of Johns-Manville is situated at Waukegan, Illinois. In this aerial view are included the office building, power plant, pumping station and seven manufacturing buildings*





*The Johns-Manville deposit at Lompoc, California covers an area of more than 5 square miles and is estimated to contain more than one hundred million tons of crude Celite (diatomaceous silica)*



*Asbestos, Quebec, the largest mine in the world for the production of asbestos fibre. It is approximately 3000 ft in diameter and 350 ft in depth*



## J-M Basic Raw Materials



*After 50,000 centuries, White Hills, California, is the scene of extensive mining operations. In the Miocene Period tiny diatoms were deposited here in great quantities. Now, their fossil remains, known as Celite, are recovered by Johns-Manville and put to work in many industrial fields*

The raw materials used by Johns-Manville, when manufactured into J-M products, enter into nearly every industry in the United States. Of these many basic raw materials, some are better known than others because they play a proportionately greater part in the manufacture of the final products. The best known and most important, of course, is asbestos. Others of prominence are dolomite rock, asphalt, diatomaceous silica, wool rock and portland cement. These, and other basic materials, are here briefly described. Asbestos is separately discussed elsewhere.

### Diatomaceous Silica

The name Celite is applied by Johns-Manville to its accumulated deposits of diatomaceous silica, consisting of microscopic cellular skeletons of sea plants called diatoms. These skeletons are so small that it requires some 2000 diatoms laid end to end to equal one inch. The diatoms were deposited in the bottom of the sea millions of years ago at the rate of about  $\frac{1}{2}$ " per year, until the bed reached a thickness of some 1400 feet. Since then the sea bed has been ele-

vated and the deposit now forms hills near Lompoc, California. This is the largest uniform source of pure diatomaceous silica ever discovered. When mined, the material may be cut into the form of bricks of almost pure silica or it may be reduced to a powder and remolded under heavy pressure into bricks and blocks.

One of the chief uses of Celite is for high temperature insulation, as in Sil-O-Cel bricks and Superex blocks. It has very fine pores which retard the circulation of air, innumerable surfaces which reflect radiant energy, low density, and a natural separation of particles. These qualities provide an unusually effective barrier to heat transfer.

Celite, in finely divided form, is extremely used as a filter-aid in removing suspended matter in solutions as, for example, Hyflo Super-Cel in clarifying sugar syrups. Used in concrete, Celite imparts workability and improves strength and appearance. Mortars, plasters and stuccos are similarly benefited. The inertness, light weight, high porosity and other distinctive properties of Celite also make it valuable as a mineral filler and delicate abrasive.



## Asphalt

It is known that asphalt was used by ancients as far back as 3000 B.C. Significantly, the first use of the substance was in the nature of a cement for securing or joining together various objects. The origin of the name itself was expressive of this application.

Technically, asphalt is a term applied to a species of bitumen composed principally of saturated hydrocarbons. Asphalts are divided into two main classifications, native and pyrogenous. Many types of native asphalts are known but relatively few find commercial application in modern asphalt products. Gilsonite, one of the most valuable of these natural asphalts, is the only one used to any extent by Johns-Manville.

Pyrogenous asphalts, which form the foundation of the asphalt industry of today, are products of petroleum. They are composed of highly stable, saturated hydrocarbons which remain behind after the volatile fractions of crude oil have been removed. This group of asphaltic compounds which is unaffected by the heat of the distillation process, is the basis for the asphalts of commerce. There are wide differences in the suitability of these asphalts for various purposes, depending upon the source of the crude oil from which they are produced. Among the principal sources of Johns-Manville asphalts are the crude oils of Mexico, Texas, Venezuela and Colombia. Johns-Manville carefully selects its crudes depending upon the final properties desired.

Before these basic asphalts are suitable for the manufacture of asphalt products they must be refined. Refining imparts to the asphalt such physical properties as hardness, melting point, ductility, etc., as are



*Asphalts derived from crude oil have definitely proved their commercial value since the beginning of the century. This battery of converters illustrates part of the refining process*

required of it in service in the finished products. Refining is accomplished by blowing either air or steam through the molten asphalt for a specified time under accurately controlled conditions.

Steam refining serves to remove some of the "lights" without producing a chemical change in the main body of the asphalt. This process raises the melting point and increases the hardness of the asphalt progressively and is continued until the specified penetration and melting point are reached. Steam refined asphalts are characterized by higher ductilities and greater temperature susceptibilities than air blown asphalts.

Blowing by air produces a rearrangement and combination of the molecules in the asphaltic constituents with the formation of new compounds unattainable by steam refining. By air blowing, asphalts are produced which have very high melting points and which are practically unaffected by ordinary weather temperature changes.

Before or after refining, modifications in the asphalt may be made by blending with other petroleum asphalts or native asphalts. Blending produces asphalts having physical properties not obtained by straight refining and having the highest durabilities.

Johns-Manville subjects these asphalts to close examination at all stages of manufacture and requires that the finished products rigidly conform to meet the required specification.

These various grades of refined petroleum asphalts are used in the manufacture of many of the most widely known products of Johns-Manville. For ex-



*A gilsonite mine located in Utah. One man can mine and sack an average of two tons per day*



ample, they are employed for impregnating asbestos and rag felt to be used in the making of roofing and waterproofing membranes for roof coatings and waterproofing compounds, and for products such as Asphalt Plank, Industrial Flooring and Rock Cork.

### Dolomite Rock

Dolomite rock, a calcium magnesium carbonate, is used by Johns-Manville to produce 85% Magnesia insulation. The dolomite is quarried and shipped to the factory where it is burned in kilns to produce a lime mixture of calcium and magnesium oxides. This mixture is slaked with water to produce calcium and magnesium hydroxides. The slurry is emptied into saturators with the required amount of water, carbon dioxide is added, and the hydroxides are converted into carbonates. The calcium carbonate is thus precipitated in solid form and the magnesium bicarbonate, which remains in solution, is transferred to kettles where it is boiled. This converts the magnesia liquor into insoluble basic carbonate of magnesia. It is then allowed to settle in tanks and the excess water drained.

The magnesium carbonate is mixed with approximately 15 percent asbestos fiber of proper grading, and pumped to the moulding room where it is moulded by presses into pipe sections, blocks and lagging. These forms are dried in ovens, then removed, cut and planed by machine to the proper size.



*J-M 85% Magnesia bears no resemblance whatever to the original dolomite, the thermal conductivity of which is ten times as great as the finished product*



*Mineral Wool, whether produced from a natural volcanic eruption or from a harnessed volcano in the factory, is an insulation of remarkable efficiency*

Next, the cloth covering is placed on the pipe insulation and the material is ready for stock or shipment.

Pipe sections and blocks are tested in the laboratory for modulus of rupture, density, dimensions, percentage of asbestos, and impurities. Each lot must conform to rigid manufacturing specifications.

### Mineral Wool

Mineral wool is manufactured principally from the slags obtained in the refining of metals. The material is carefully selected in order to fulfill requirements essential to the production of a superior mineral wool of high insulating value and stability.

The raw material, with a certain percentage of coke, is first melted in cupolas. As the molten mass flows from the cupola a jet of steam under high pressure is directed against it. The steam breaks up the white-hot mineral into wooly, fibrous clots. These clots are immediately sprayed with a thin stream of either oil or waterproofing solution, depending upon the type of wool being manufactured. By the force of the steam the particles are blown into a long rectangular chamber and, cooling and dropping, they present a scene similar to a snow fall. These fibers of wool are of varying lengths. As they descend, they build up a blanket which is carried on a moving belt to the end of the chamber, ready for manufacture into various important types of J-M products, such as Home Insulation in batt and granular forms, Banroc Blankets, sound absorbing materials and Rock Cork.



## Portland Cement

Portland cement, used with asbestos fiber to produce the many J-M Transite products, is made from a calcined mixture of about 75 to 80 percent limestone, chalk or marl and 20 to 25 percent clay, shale or slag. The raw materials are mixed, ground and burned to a clinker in special kilns, then again ground to a fine powder, after which the cement is ready for use.

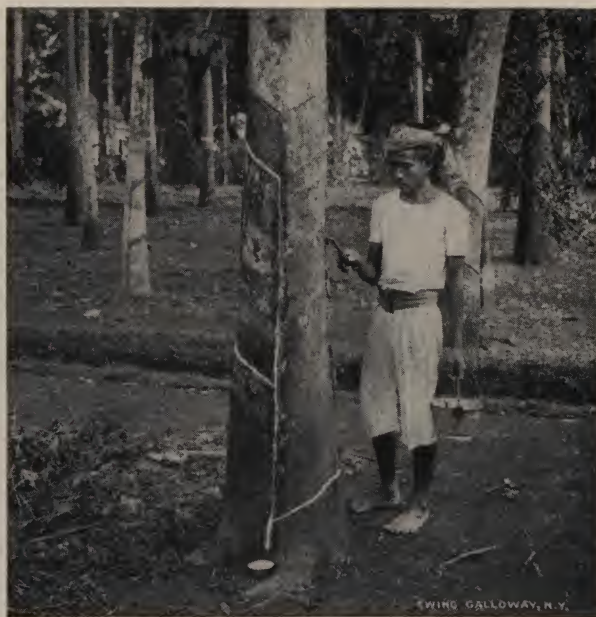
## Cotton

Cotton fiber consists of the hairy covering of the seeds of the cotton plant. The fiber is detached and separated from the seed, spun and woven into cloth. Different kinds of cotton are largely distinguished by the length of the fibers. The degree of ripeness of the fibers when they are picked determines their general character. The fineness varies somewhat with the place of growth.

Johns-Manville uses cotton in conjunction with the spinning of asbestos. For certain grades of product, small quantities of cotton are incorporated to facilitate the spinning of the asbestos fibers. Cotton fabrics are used by Johns-Manville in combination with asbes-



*Cotton presents one of the most interesting stories in the history of business. In a highly mechanized industry, picking is still largely a hand operation*



*Rubber production in Java "milks" the trees of every drop of latex not needed to maintain life, health and strength*

tos felts in the construction of built-up waterproofing. Jackets on pipe insulation offer another example of the use of cotton.

## Rubber

Both natural and synthetic rubbers are used by Johns-Manville, depending upon the requirements.

Natural rubber occurs as a milk-juice found in a great variety of vines, shrubs and trees growing in the moist climates of tropical and sub-tropical countries. The juice, or latex, has the consistency and appearance of thin cream, and ordinarily contains 30 to 40 percent rubber.

The best known properties of natural rubber are, great elasticity, pliability, high resistance to abrasion, and dielectric value. When processed, compounded, vulcanized, or otherwise treated, it is used for a great variety of purposes.

Synthetic rubber, such as Neoprene, Buna S, Buna N, and Butyl, became vitally important as war-emergency substitutes for crude rubber. However, even prior to the war, J-M made use of special synthetics which offered particular qualities such as resistance to oils and other advantageous properties superior to natural rubber.

Typical uses of rubber by Johns-Manville are in the manufacture of certain packings, brake linings and clutch facings.



## Clay

Clay is found in natural deposits, which may be classified according to their origin, chemical properties and uses. The most important properties in clay include development of plasticity when mixed with water, and hardening under the influence of heat. Most clays are composed chiefly of silica and alumina. Varying quantities of other minerals and sometimes organic matter are mixed with clay to produce further raw products. Specially treated clays are used by Johns-Manville in the manufacture of high temperature cements.

## Wood Fiber

Wood fiber forms the base of the largest percentage of all paper manufactured in the United States. From the lumber camps the wood is transported to the paper mill where it is barked, pulped by mechanical or chemical means and treated to produce a quality of stock which may be run through the paper machines or otherwise fabricated. Spruce, pine, fir, hemlock, poplar and other species are used for making pulp. Johns-Manville standard and decorative insulating board materials offer a good illustration of the use of



*Clay are produced from underground mines or from open quarries and beds. Composition varies widely and manufacturing specifications are correspondingly strict*

wood fiber in the production of many products of commercial utility. The board is made from pure southern pine fibers felted and formed between pressure rolls into sheets. The natural insulating qualities of wood are increased when treated in this manner.



*A stand of "loblolly" pine on one of the J-M tracts*

## Flax

Flax is a fine textured fiber obtained from the linseed plant, famous for making linen. The plants are "retted," or partially decayed, cleaned and the fibers combed out. The result is a commercial product, ready for manufacturing. Flax is used by Johns-Manville for cold water packings.



## Rags and Paper Stock

The manufacture of paper is largely based upon the production and preparation of suitable fiber in a form that can be accommodated by the paper machines. The more durable felts and papers and those to be used at higher temperatures are manufactured from asbestos, but wood pulp, newsprint, wool rags and other fibrous materials are utilized by Johns-Manville for many purposes.

By varying the proportions of the raw materials, the desired properties can be produced in the finished product. The raw materials are sorted, cut up mechanically and delivered to the beaters where the fibers are washed, beaten, and reduced to the proper condition for the paper machines.

Johns-Manville makes use of rag felts in the manufacture of certain types of roofing and waterproofing membranes. In this case, the felt serves merely as a carrier for an impregnating material upon which the chief use of the product is dependent. Building papers and wool felt pipe insulation offer other examples of the use of these materials by Johns-Manville.

## Hair

Cattle hair, a product of the stock yards, is used for various industrial purposes. Its chief value to Johns-Manville lies in its insulating qualities, which are made use of for low temperature insulation in such



*This interesting scene of a grazing herd of beef cattle in Montana presents a somewhat detached picture of the original source of cattle hair*



*A J-M laboratory determination of the quality of flax fiber which enters into the manufacture of J-M Flax Packing. Extraction apparatus for testing impregnants used in the flax is also shown*

J-M products as Carinsul, Built-up Hair Felt and Brine and Ammonia Pipe Insulation. Goat hair combined with asbestos fiber serves as an acoustical absorption medium, particularly effective in the form of J-M Akoustikos Felt.

## Other Materials

It would be impossible to treat separately all other basic raw materials in the space allowed. However, in an attempt to show diversification, typical examples of other materials used by Johns-Manville have been grouped together as shown in the following general classification:

**Metals:** The common commercial metals, including aluminum, brass, copper, iron, lead and zinc.

**Minerals and Inorganic Chemicals:** Asbestine, barytes, bauxite, graphite, lime, mica, sand, silica, slate, sulphur, trap rock, kaolin, lampblack, litharge, plaster of paris, sodium silicate, talc, whiting, zinc chloride and oxide pigments such as chromium, iron, titanium and zinc oxides.

**Organic Chemicals, Oils and Solvents:** Alcohol, aluminum stearate, ammonium stearate, carbon tetrachloride, casein, formaldehyde, gasoline, glycerine, glues, mineral and vegetable oils, naphtha, oleic acid, petroleum and coal tar solvents, pitches, starch, synthetic resins and waxes.

**Fibers, Cloths and Fabrics:** Materials such as burlap, canvas, duck, kapok, muslin and sponge.



## Johns-Manville Asbestos

Asbestos is undoubtedly the most remarkable product of inorganic nature. As found in the natural rock, asbestos itself is dense, heavy, often dark-colored and usually has the aspect of stone. When picked apart or "teased up", however, the best grades break down into a mass of delicate, interlacing, light-colored threads which appear somewhat like silk fibers.

Some kinds of asbestos are more useful than others for certain purposes but there is one quality which inheres in all varieties, that of incombustibility. Although its strength may be affected or its appearance changed, when subjected to intense heat, there is no questioning the well-established fact that asbestos will not burn.

Known principally as a curiosity in ancient times, in the last half century it has become the world's most essential non-metallic mineral. Nowhere else is found such a peculiar combination of qualities as those which make asbestos commercially important in the manufacture of heat and electrical insulating mate-



*Asbestos—the mineral paradox—dense as the rock in which it occurs, yet actually a mass of silky fibers; the link, as it were, between the vegetable and the mineral kingdoms—at once crystalline and fibrous, heavy as stone in its crude state, yet light as thistle-down when mechanically treated; each delicate fiber an enduring barrier against all the forces of nature. In this specimen of crude asbestos, its fibrous nature is clearly apparent as the pieces are pulled apart*



*Close-up of a ledge-face in one of the Johns-Manville mines, showing veins of the finest cross-fiber chrysotile asbestos in place in the serpentine matrix*

rials, textile products to resist high temperature, refractory compounds, asbestos-cement products, and hundreds of other familiar applications such as asbestos theatre curtains, acoustical treatments, friction clutches and brake linings.

Asbestos and asbestos products have greatly reduced the losses of life and property which yearly assume such alarming proportions. The use of asbestos building materials represents the highest type of modern construction known to building practice. Steel rusts, wood rots and stone disintegrates but asbestos seems to be proof against all these ordinary forces of nature. In industrial usage, the economies effected by asbestos, through the reduction of depreciation, power losses, and fuel waste, amount to many millions of dollars annually.

The fire safety and comparative permanence of rigid asbestos shingles, sheet asbestos and asbestos built-up roofing go hand in hand with the savings and economies brought about by heat-resisting products like asbestos insulations, packings and brake linings, the manufacture of which would be impossible except for the enduring properties of the mineral asbestos.



In commercial usage, the terms "asbestos" usually refers to chrysotile, which is hydrous magnesium silicate, ordinarily containing some ferrous iron but only small quantities of calcium. The approximate chemical formula is  $H_4Mg_3Si_4O_9$ . In color the fiber ranges from pure, lustrous white to shades of gray.

ANALYSIS OF TYPICAL J-M CHRYSOTILE

Composition	Percent
Silicon (expressed as $SiO_2$ ) . . . . .	41.8
Iron (expressed as Oxide) . . . . .	2.1
Magnesium (expressed as $MgO$ ) . . . . .	41.9
Aluminum (expressed as $Al_2O_3$ ) . . . . .	—
Sodium . . . . .	—
Water . . . . .	14.1

Chrysotile asbestos is more commonly employed in manufacturing asbestos products, not only because of its ready availability and comparatively low cost but also because its qualities are well adapted to most of the purposes for which asbestos is employed.

Its characteristic silk-like appearance, exceedingly fibrous and delicate texture, flexibility and high tensile strength have always distinguished the better grades of chrysotile asbestos from fibers less suited to general practical use in industry.

Chrysotile is also supreme in its capacity for resisting heat—a matter of first importance in most of the manufactured products in which asbestos is used. Its remarkable properties, in this respect, are thought to result from its high magnesium content.

Because of its flexibility and fineness of fiber, chrysotile has achieved great commercial importance in connection with the manufacture of asbestos yarn. In the beginning, asbestos fiber was difficult to spin because, unlike other fiber, its surface is perfectly smooth. Now, however, manufacturing difficulties have been overcome and strong asbestos threads can be twisted from chrysotile fiber which will weigh less than one ounce per hundred yards.

In the great bulk of the chrysotile mined, the fibers are too short for spinning, but here, as in the case of the longer fiber, the advantage of its flexibility is great, whether the fiber is to be used as a bonding agent or in the manufacture of products such as are fabricated on a paper machine.

Many qualities of asbestos are not revealed by chemical analysis or ordinary physical specifications.



*From the Johns-Manville pit, at Asbestos, P. Q., approximately 3000 ft in diameter and 350 ft deep comes more fiber than from any other asbestos mine in the world. Its 10 giant shovels, 18 locomotives, both steam and electric, and the hundreds of capacious dump cars can move 15,000 tons of asbestos-bearing rock in a day. The property has actually produced over 225,000 tons of asbestos in a single year. Such a high tonnage necessitates the removal in the way of overburden, rock and mill ore, of approximately 3,500,000 tons*

The difference may be inherent in the fiber itself or it may be the result of the methods of milling and treatment which distinguish the product of one plant from that of another.

Johns-Manville asbestos, which is characterized by great flexibility, tensile strength and silkiness, is marketed throughout the world. Between the shortest fiber, used principally in moulded materials, and the longest; used chiefly for spinning, lies a wide range of grades, each especially applicable to the manufacture of some one of the thousands of asbestos products.











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## Floorings

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#### *Asphalt Boat Deck Covering:*

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Application over wood and concrete decks . . . . . BMF-220

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#### *Terraflex Tile Flooring*

Carton Conversion Chart . . . . . BMF-450

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## J-M Industrial Flooring

(Hot Mastic)



*Still in excellent condition, this J-M Industrial Flooring has resisted the wearing action of heavy pier traffic for over 22 years*

J-M Industrial Flooring is a smooth, monolithic floor surfacing material with a wide range of adaptability. It will not crack or buckle under atmospheric changes nor will it grind off or ripple under severe traffic. The acid-resistant type withstands the action of most acids, brines and alkalis; however, all types are waterproof, termite-proof and also highly fire-retardant as demonstrated by tests.

This J-M Flooring has no cracks or crevices in which dust, dirt and vermin can collect. Furthermore, it is not porous and, as a result of these characteristics, it can be easily cleaned by flushing with water. It dries quickly, minimizing dampness.

Because it has an asphaltic binder, this flooring is resilient under foot. It deadens trucking noise and sounds caused by the handling of crates, packing boxes and other large objects. Under the wearing action of heavy trucking, J-M Industrial Flooring will not originate dust. This not only makes working conditions more healthful but also saves wear on machinery caused by dust filtering into moving parts. The fact that this floor has good skid resistance is a safety feature which decreases accidents.

J-M Industrial Flooring consists of a selected mineral aggregate bonded with asphalt. The mineral aggregate in the finished floor depends upon the thickness of the floor but usually ranges in size from that

which passes a  $\frac{3}{4}$ " screen down to that passing a 200-mesh screen, so graded as to secure the smallest percentage of voids obtainable in practice. The asphalt which is used to bond the aggregate is selected for the conditions to be encountered in service.

To assure the proper percentage of fine mineral aggregate and its thorough mixing with the asphalt, J-M Industrial Flooring Blocks, composed of asphalt, limestone dust or silica flour, and sand, in certain fixed proportions, are made at the factory. They are melted down into a hot mastic which is poured in place. Each block weighs approximately 74 to 84 lb.

### Highly Acid Resistant

Where there are acid conditions, every flooring has certain limitations. There is no such thing as an acid-proof floor. Some acids will destroy the asphalt, and others the silica aggregate. J-M Acid-Resisting Flooring is, however, highly acid-resistant. J-M Industrial Flooring material will stand up under certain acid conditions at normal temperatures when the same acids, heated, would destroy them. In general, J-M Acid-Resisting Flooring will withstand the action of acids at normal temperatures, as follows:

**Sulphuric Acid:** J-M Acid-Resisting Flooring will prove satisfactory under this acid up to a 50 percent solution at room temperatures but is not guaranteed



to resist heated sulphuric acid, although laboratory tests indicate safety on unconfined acid of 50 percent concentration up to 125 F.

**Hydrochloric Acid:** A 35 percent solution of commercial acid in water at room temperatures has practically no effect on J-M Acid-Resisting Flooring.

**Nitric Acid:** A 20 percent solution of nitric acid will not affect J-M Acid-Resisting materials at room temperatures, but, above that percentage and temperature, the acid has a decided effect. Warm nitric acid is very injurious.

**Hydrofluoric Acid:** A 45 percent solution will dissolve silica rapidly. J-M Acid-Resisting Flooring in many cases has withstood the action of a 10 percent solution satisfactory but generally it is not recommended where hydrofluoric acid conditions prevail.

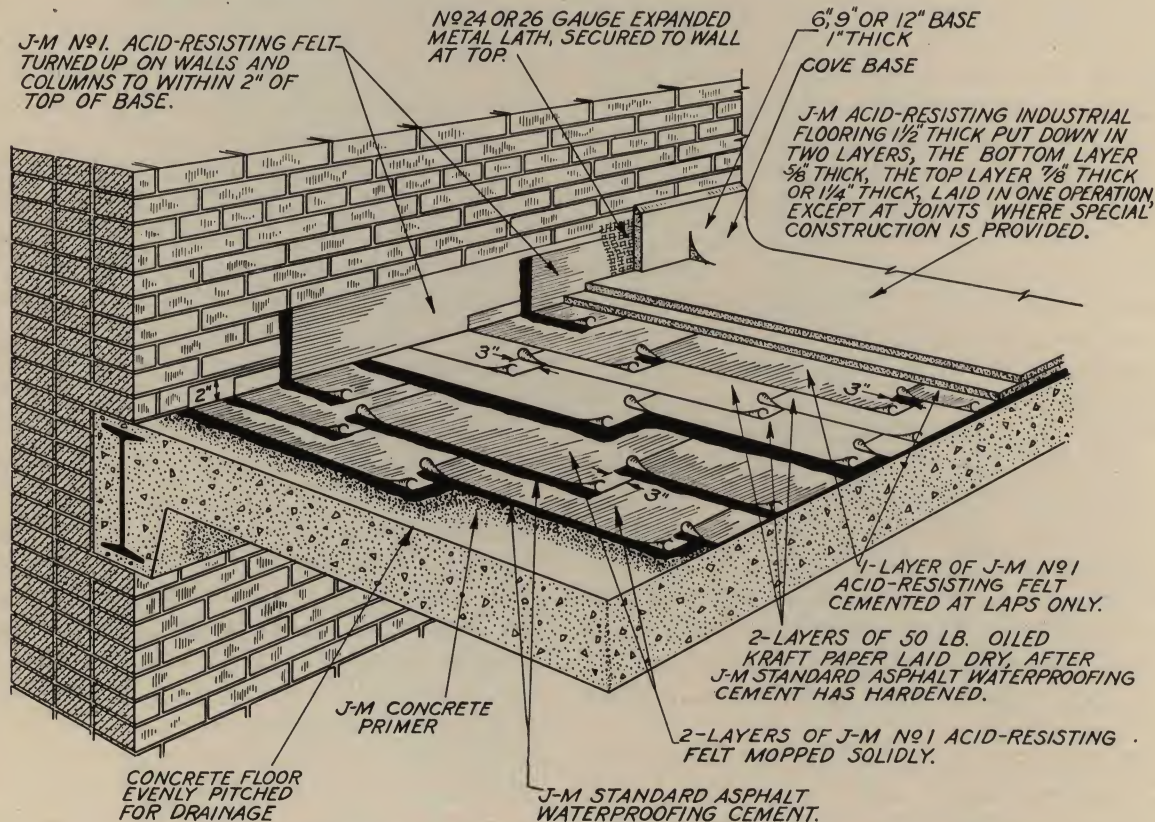
When the floor is exposed to mild, organic acids, J-M Industrial Flooring will give more satisfactory service than any other type, provided it is kept clean by daily flushing with hot water and a cleanser. Without such proper maintenance, any floor will give trouble under similar conditions.

Battery rooms require a flooring not only immune to the action of the acids used, but which also will

withstand the static load of the batteries without an appreciable settlement of the battery supports into the floor surface. J-M Industrial Flooring, of a particular specification, has met these requirements in a manner satisfactory to such concerns as Storage Battery Companies, Consolidated Edison Company and the New York Telephone Company.

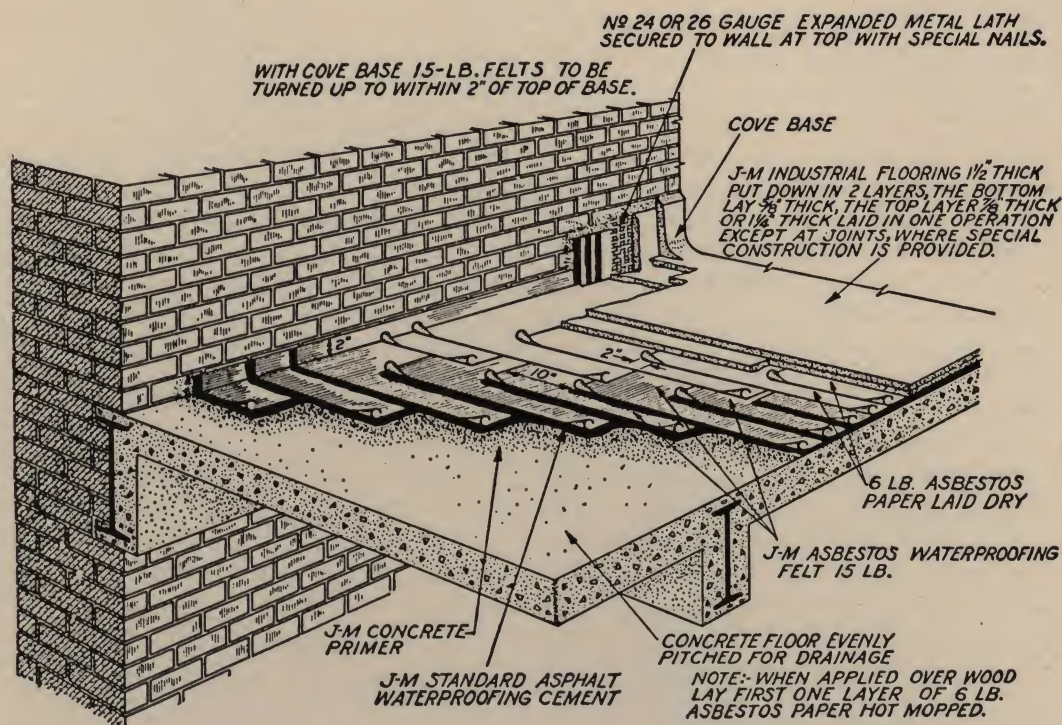
### Uses of Industrial Flooring

The uses of J-M Industrial Flooring are extensive. It is suited not only to heavy foot or wheel traffic in industrial plants, factories, warehouses and institutions, where the floors suffer severely from general hard usage, but, because of the adaptability of its construction and its peculiar natural qualities, it is a highly satisfactory top flooring in public buildings, school houses (corridors, stair treads, basements, locker and wash rooms), railroad platforms and concourses, freight houses, machine shops, chemical laboratories, packing houses, laundries, battery rooms and gymnasiums. In fact, for every type of building, the wear-resisting, sanitary, skid-resistant, waterproof, noiseless and fire-retarding qualities of J-M Industrial Flooring make it a logical floor surfacing.



Construction details of J-M Acid-Resisting Industrial Flooring with membrane waterproofing





Construction details of J-M Standard Industrial Flooring with waterproofing membrane

### J-M Industrial Flooring Blocks

To meet various conditions, J-M Industrial Flooring Blocks are manufactured in two types: Standard and Acid-Resisting.

**Standard Block:** Composed of 13 percent asphalt, 27 percent sand, and 60 percent limestone dust (90 percent of the limestone dust passing a 200-mesh screen). The blocks weigh about 83 lb each.

**Acid-Resisting Block:** Made of 18 percent asphalt, 50 percent silica sand, and 32 percent silica flour. Silica flour is used instead of limestone dust because of its resistance to most acids. Each block weighs approximately 74 lb.

### J-M Asphalt Fluxes

J-M Asphalt Fluxes, shipped with the flooring block, vary in consistency from asphalts much harder than that used in the block itself, to those somewhat softer, and are designated by their penetration figures, as No. 5, No. 15, No. 25, No. 40, and No. 60. The lower the number (or penetration), the harder the asphalt. With the asphalt in the block having a 25 penetration, Flux No. 40 or No. 60 will naturally soften the floor. The reverse is true with the harder fluxes, No. 5 and 15. The shipping weight of full drums of these fluxes is approximately 425 lb.

No. 5, the hardest flux, is used where extreme service conditions are encountered, and temperature changes are not abrupt.

No. 15 is a medium hard flux and is recommended where service conditions are severe and temperature changes are more or less abrupt.

No. 25 has the same penetration as the matrix of the blocks and is used where an increase in asphalt content is desired.

No. 40 is a medium soft flux, and is recommended for floors in rooms having temperatures ranging from 30 to 50 F.

No. 60 is the standard soft flux, generally used in cold room work and for refrigerator floors where continued low temperatures provide all necessary hardness. Recommended for temperatures below 30 F.

### Application

On the job, J-M Industrial Flooring Blocks are melted down at approximately 450 F with J-M Asphalt Fluxes and combined with the coarse mineral aggregate, such as grit, gravel, or crushed stone or granite. The hot mastic is then poured into place and spread to the proper thickness. The floor can be put into service as soon as it has cooled.

J-M Industrial Flooring is laid in various thicknesses from 1" to 3", according to requirements. A



1" thickness is generally specified for foot traffic or light trucking, 1¼" for average trucking, 1½" for heavy trucking and 2" or 3" for special cases.

It can be laid over any substantial base such as wood, concrete, brick or tile, which in itself is strong enough to carry the required load without excessive vibration. The Industrial Flooring does not add structural strength. It is merely a floor covering or topping to protect the base over which it is applied.

The flooring weighs approximately 12 lb per sq ft, 1" thick; other thicknesses in proportion.

### *Easily Repaired:*

When accident or unusually severe use causes wear in spots, repairs can be made easily and economically. The affected portion may be chiselled out, remelted with the proper amount of flux and aggregate, and re-laid. The patch becomes an integral part of the original floor, with no unsightly edges. As soon as the patch has cooled, which is in about three hours after it is made, traffic may be resumed.

### *Exceptional Conditions:*

There are unusual floor conditions which demand special attention. Ordinary indentations of heavy loads will iron out of J-M Industrial Flooring under traffic, but where temperatures are high and loads are left standing on small bearing areas for long periods of time, indentations cannot be expected to iron-out readily. Such conditions are generally found

around printing and punch presses and similar equipment. Armor plates should be used in such cases.

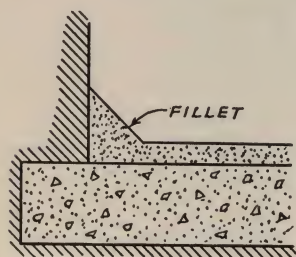
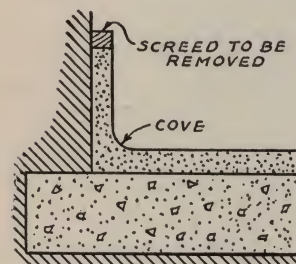
Oil drip or splash in machine shops and around screw cutting machines, etc., necessitate a certain amount of protection in the way of sawdust or sand to absorb the oil. This is nothing more or less than "good housekeeping" which is necessary for any type of flooring, not only to protect the floor, but also from the standpoint of neatness around the plant. A slight amount of oil is not harmful to J-M Industrial Flooring, but will rather tend to increase its life.

### **Comparison of Floorings**

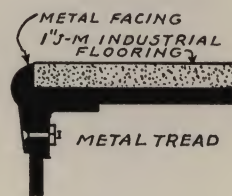
The following table compiled from authoritative data shows the various properties of J-M Industrial Flooring and other types of flooring. The numerals indicate the comparative value of the floor in question, based on 100 as absolute.

	J-M Industrial Flooring	Common Brick	Paving Brick	Concrete	Maple	Oak	Pine
1. Acid-Resistant ...	100	80	100	50	30	33	30
2. Alkali-Resistant ..	100	95	100	70	90	90	80
3. Durable .....	75	60	100	90	50	50	40
4. Elastic .....	60	0	5	1	90	90	80
5. Fire-Resistant ...	75	100	100	100	0	0	0
6. Non-Abrading ...	95	0	30	10	95	95	88
7. Skid-Resistant ...	100	100	30	70	50	50	60
8. Quiet .....	75	10	5	5	50	50	60
9. Resilient .....	90	0	4	1	90	90	90
10. Sanitary .....	70	6	50	40	35	35	0
11. Thermal Insulation	60	10	0	5	90	90	90
12. Waterproof .....	100	0	10	60	25	25	25
Average .....	83.3	38.4	44.5	41.8	57.9	58.2	53.6

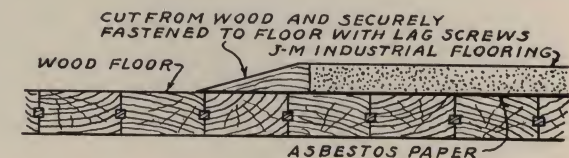
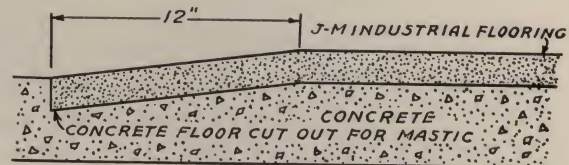
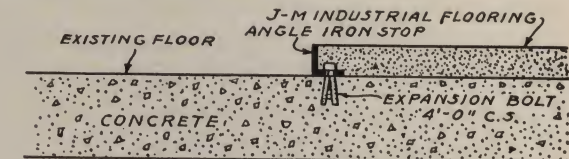
### **Application Details on J-M Industrial Flooring**



BASE AND COVE  
DETAILS



STAIR TREAD  
DETAIL



DETAILS OF CONNECTION BETWEEN J-M  
INDUSTRIAL FLOORING AND EXISTING FLOORS



## J-M Industrial Flooring Plank



*Supplied in convenient-size slabs. J-M Industrial Flooring Plank is easily and economically applied*

In certain industries there is a consistent demand for a flooring surface which is resilient, durable and economical. To meet this need, Johns-Manville Industrial Flooring Plank, a grainless, quiet, dustless product, has served satisfactorily for many years. The plank is manufactured in lightweight, convenient, individual units, and it is furnished in three colors—red, brown and black.

J-M Industrial Flooring Plank is a mixture of tough fibre, high melting point, low penetration asphalt and graded mineral filler, densely compressed and die cut into rectangular planks or slabs, 12" x 12" and 12" x 24" in 1/4", 3/8" and 1/2" thicknesses. The approximate weights, exclusive of cartons, are 2, 3 and 4 lb per sq ft, respectively, according to the thickness. The material is shipped in cartons weighing approximately 65 lb gross weight.

Industrial Flooring Plank is rapidly and easily applied and is ready for use as soon as it is laid. Like all plastic materials, the plank will mark to some extent under static loads resting upon small bearing areas. Except in extreme cases, however, this causes no permanent damage to the surface of Industrial

Flooring Plank. All ordinary indentations quickly iron out under the action of traffic due to the natural resiliency of the material and to its high asphalt content, so that the trucking surface actually improves with use. Should any part of the floor be seriously injured through accident, the damaged planks are quickly replaced and the repaired section is ready for traffic immediately.

Since the plank is a machine-made product of standard composition, in contrast to surfacing materials which are mixed on the job, the personal equation is limited to the process of application only. As the success of the installation is entirely dependent upon proper application, strict adherence is necessary to Johns-Manville directions for application.

While J-M Industrial Flooring Plank does not add to the structural strength of the floor system, it does protect the underfloor from traffic abrasion and other damage which might decrease its strength.

The availability of the plank in three colors provides a pleasing decorative effect without sacrificing the ruggedness and durability required for severe trucking and service requirements.



## Where Industrial Flooring Plank Is Used

J-M Industrial Flooring Plank is recommended for use over smooth, plane, non-deflecting sub-floors in warehouses and manufacturing buildings where heavy static loads are not resting on small bearing areas, and where the floor is not exposed to water, other liquids, or abnormal temperatures. The presence of acids, free creosote, vegetable or animal oil or hot drippings of any kind, prohibits the use of the plank.

For sub floors which do not conform with these standards by a slight margin, but which are of good quality, the more flexible J-M Asphalt Bridge Plank may be used. However, Asphalt Bridge Plank has a greater tendency to indent and increase tractive resistance at higher temperatures.

Where liquid and acid conditions are encountered, J-M Industrial Flooring (Hot Mastic) may be adaptable, depending upon the particular conditions of the job. J-M Asphalt Bridge Plank and J-M Industrial Flooring are described on other data sheets.

The utility of J-M Industrial Flooring Plank has been proved by successful installations in plants involving the manufacture of such products as steel, rubber, furniture, tobacco, shoes, brass, automobiles and textiles. Other widely varying applications include subway cars, railroad stations, printing plants, cold storage and many other types of warehouses.

## Application of Industrial Flooring Plank

Traffic and the base upon which it is to be laid determine the proper thickness of J-M Industrial Floor-



*In this shoe factory, the durable floor surface of 1/2"-thick Industrial Flooring Plank stands up well under the wearing action of the racks used to transport shoes*



*Once in place, a floor of J-M Industrial Flooring Plank is ready for immediate use. This feature is also advantageous when damage caused by accident requires quick repairs*

ing Plank. The underfloors should be structurally adequate and rigid without any deflection or vibration. The surface of the underfloor should be strictly smooth, without any irregularities and depressions. Underfloors that are at any time subject to a head of water or to seepage must be properly waterproofed.

For the general run of heavy duty requirements, the 3/8" thickness is usually sufficient, although the 1/2" thickness may be used if preferred. The 1/4" thickness over concrete, 3/8" or 1/4" over wood, may be used for foot traffic or extremely light trucking.

Over suitable sub-floors, Industrial Flooring Plank should be applied with a thin layer of J-M Asphalt Tile Cement, Type B, in order to provide a secure bond. The cement is furnished in 1, 5 and 30-gal containers, and weighs approximately 10 lb per gal.

Under no circumstances should Industrial Flooring Plank be nailed. Excessive irregularities in concrete sub-floors must be filled with cold mastic to produce a plane surface. The joints between planks should be closed tightly by crowding each plank, as it is laid, against those already in place.

Industrial Flooring Plank should not be left with unprotected edges. A suitable header or edging should be securely attached to the sub-floor not only to protect the edges of the plank but also to prevent accidents caused by workmen tripping over them. Complete details are given on other data sheets.

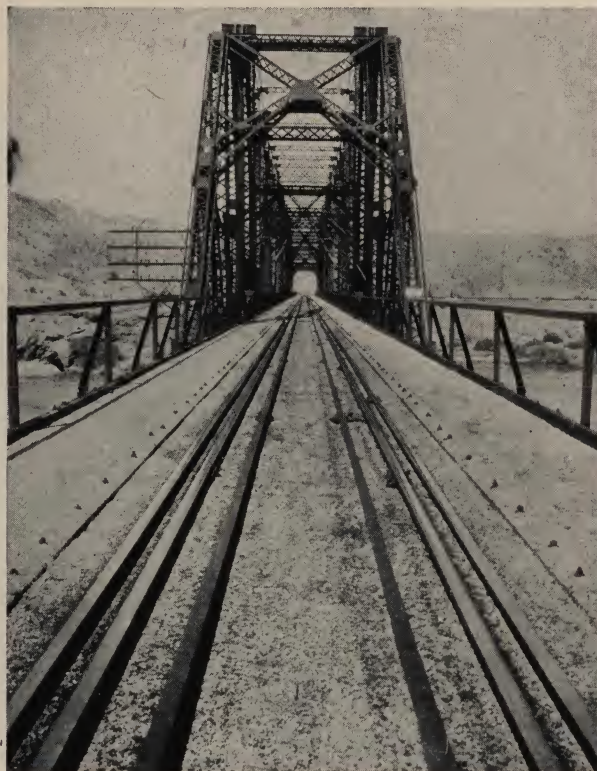


## Johns-Manville Fire-decking for Railroad Trestles and Bridges

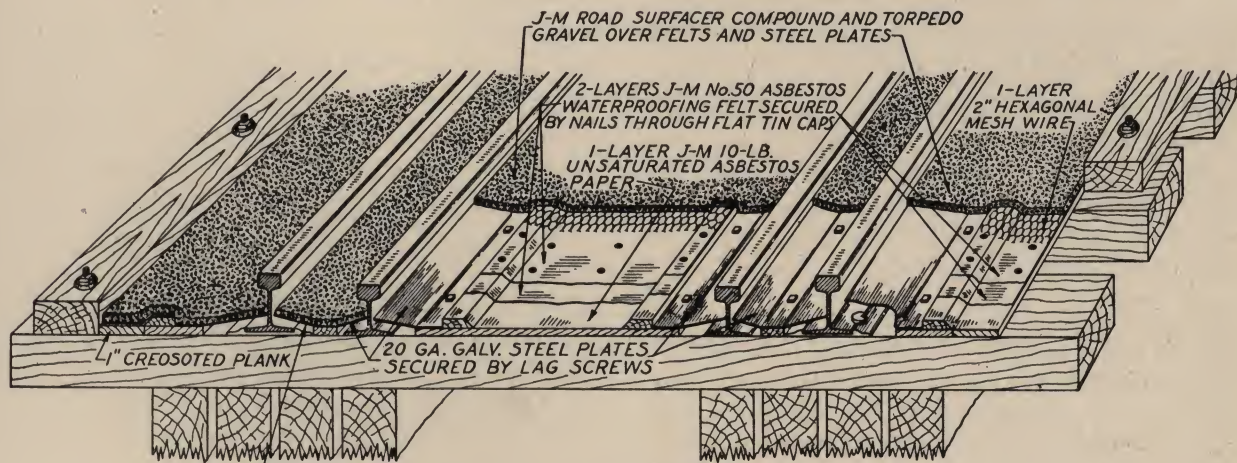
The timber work of railroad trestles and bridges needs protection from the constant fire hazard of locomotive droppings, molten brake shoes, etc., as well as from the elements and brine drip from cars. To provide this protection, Johns-Manville furnishes Built-up Fire-decking.

J-M Fire-decking consists of creosoted planking over the ties, upon which is laid one course of J-M 10-lb Asbestos Paper (unsaturated); over this course is shingled two layers of J-M No. 50 Asbestos Waterproofing Felt, the felts and paper fastened to the planking by galvanized nails through flat tin caps. A 2" hexagonal mesh wire is securely stapled over the felt. Then two layers of J-M Road Surfacers Compound and washed torpedo gravel are applied.

J-M Road Surfacers Compound is an asphaltic product of low melting point, shipped in drums of approximately 475 lb. It is heated, on the job, to 350 deg F, and spread over the Asbestos Felt and hexagonal mesh wire in quantities of 80 lb per 100 sq ft. Into the hot compound is rolled a  $\frac{1}{4}$ " to  $\frac{1}{2}$ " thick layer of torpedo gravel ranging between  $\frac{1}{8}$ " and  $\frac{1}{2}$ " in size. Any surplus gravel which does not adhere to the Road Surfacers Compound is swept off the first layer. A second layer of compound is then applied, followed by a second layer of gravel, rolled in, all of which is allowed to remain for a weather surface.



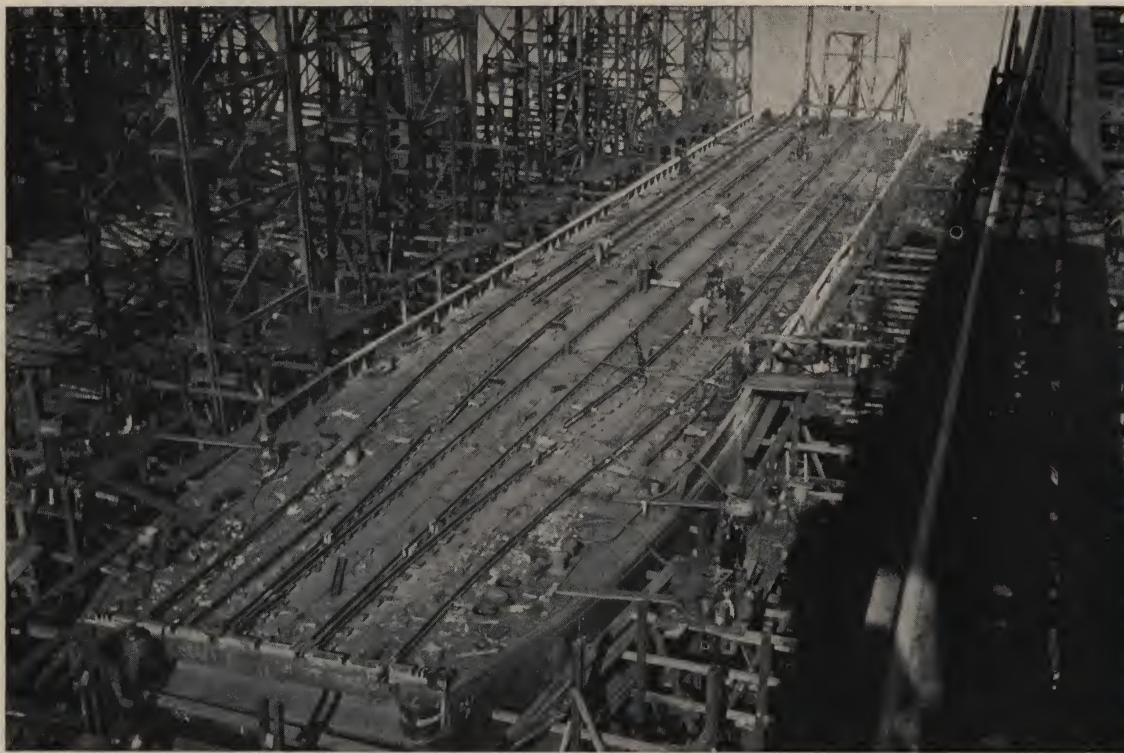
J-M Fire-decking on 1300-ft bridge over the Colorado River protects the timber work from the constant fire hazard of locomotive droppings, molten brake shoes, etc., as well as from the elements and brine drip from cars



NOTE: IN SIGNAL CONTROL TERRITORY USE  $\frac{1}{4}$ " THICK TRANSITE BOARD  
Construction of J-M Fire-decking for railroad trestles and bridges. Note the method used to allow for movement of the track without injury to the Fire-decking



## J-M Asphalt Boat Deck Covering



*J-M Asphalt Boat Deck Covering on a car-float*

To prevent rust and corrosion of the steel decks of car-floats and similar marine equipment and thus eliminate the continual expense of removing and replacing protective coatings of paint, Johns-Manville developed Asphalt Boat Deck Covering.

This composition mastic, consisting of asphalt and fine aggregate, is similar to J-M Standard Industrial Flooring. It is furnished in blocks which are melted down with aggregate and asphalt fluxes of a penetration depending upon service conditions, placed in position and screeded to the desired thickness.

J-M Asphalt Boat Deck Covering has been successfully used on a number of car-floats of the New York Central, the Erie, the Santa Fe and other railroads.

### *Application:*

After the steel surface has been thoroughly cleaned of rust, paint, grease, etc., it is heavily coated with

J-M Bitumen Solution, which is allowed to dry for at least 12 hours.

Onto the dry priming coat one layer of J-M 15-lb Asbestos Waterproofing Felt is hot-mopped with J-M Standard Asphalt Waterproofing Cement.

Over this felt the Asphalt Boat Deck Covering, melted to 450 deg F, is applied hot in one or two coats to a thickness of  $\frac{3}{4}$ " to  $1\frac{1}{2}$ ", depending upon conditions to which the deck will be subjected.

After the Asphalt Boat Deck Covering has cooled, the deck may be immediately put in service.

Repairs to spots accidentally damaged may be made easily by cutting out the affected portion, adding the scrap to a sufficient quantity of new material, re-melting the mixture, pouring it in place and leveling. By piling the hot material for a short time on the cut edges to soften them, the patch will make a perfect bond and become an integral part of the deck covering.



## J-M Asphalt Bridge Plank

A surfacing material for modern traffic conditions on high-speed, heavy duty highway bridges must meet the rigid requirements of skid-resistance, durability, lightness, and low cost. J-M Mineral-Surfaced Asphalt Bridge Plank combines all of these qualities.

### Types of Asphalt Bridge Plank

J-M Asphalt Bridge Plank, a mixture of asphalt, fiber and finely divided mineral filler, is available in two types: Mineral-Surfaced and Smooth-Surfaced. The former is produced by die-pressing coarse trap rock in the surface of the plank in such a manner as to interlock the stone permanently with the fibrous asphaltic body. The Mineral-Surfaced Plank provides a traffic surface with all the inherent advantages of the smooth-surfaced plank as well as offering greatly improved skid-resistance when wet. Because of this "resistance to skid," mineral-surfaced plank should be used for highway bridge surfaces instead of smooth-surfaced plank which is more commonly used as part of the waterproofing element on ballasted deck railroad bridges.

### Thicknesses, Sizes and Weights

Mineral-Surfaced Plank				Approx. weight, lb per sq ft
1"	x 12"	x 24"	Straight Side	8.50
1 1/4"	x 12"	x 24"	" "	10.50
1 1/2"	x 12"	x 24"	" "	12.50
Smooth-Surfaced Plank				
1/2"	x 12"	x 24" or 48"	straight Side	4.0
3/4"	x 12"	x 24" or 48"	" "	6.0
1"	x 8"	x 36" or 72"	" "	8.0
1 1/4"	x 8"	x 36" or 72"	" "	10.0
1 1/2"	x 8"	x 36" or 72"	" "	12.0
2"	x 8"	x 36" or 72"	" "	16.0

**Selection of Proper Thickness:** The selection of the proper thickness of Asphalt Bridge Plank depends upon the sub-floor. The 1" thickness is satisfactory when the plank is cemented to a smooth, solid sub-floor, such as smooth concrete, matched timber with a plane surface, or steel. Slightly uneven sub-floors or those which deflect a small amount under normal loads, require 1 1/4" or 1 1/2" plank.

Asphalt Bridge Plank is a wearing surface only. Regardless of thickness, it does not increase the structural strength of a bridge deck nor can it be expected to perform satisfactorily when applied over uneven or deflecting sub-floors.



*J-M Mineral-Surfaced Plank on this large bridge assures maximum resistance to skid*

### Characteristics of Asphalt Plank

The following characteristics apply both to the Smooth-Surfaced and the Mineral-Surfaced Plank.

**Light in Weight:** J-M Asphalt Bridge Plank offers a heavy-duty, wearing surface which weighs much less than mixtures of mineral and asphalt or tar.

Approximately, asphalt planking weighs 100 lb per cu ft, in comparison to 150 lb per cu ft for the various bituminous road mixtures. Furthermore, asphalt planking is generally used in thicknesses of 1" and 1 1/2", involving weights of only 8 or 8 1/2 lb and 12 or 12 1/2 lb per sq ft, compared with 2" and 3" of bituminous mixtures weighing about 25 and 38 lb per sq ft. One inch of asphalt plank may be considered equivalent to 2" of wood for a wearing surface, so the weight per sq ft of wood and asphalt plank are practically the same for the thicknesses used in practice.

**Allows Traffic Immediately After Application:** Unlike many pavements which must be given time to set or harden, Asphalt Bridge Plank is ready for duty the moment it is laid.

**Easily Maintained:** Should an unusual condition result in injury to some portion of the bridge, it is a very simple matter to replace only the affected slabs.

**Dustless and Quiet:** Asphalt Bridge Plank is not subject to abrasion and, being of fibrous character,



has no tendency to grind off under traffic. Also, it tends to absorb vibration and wheel noise.

**Simple and Easy Application:** Special equipment and skilled mechanics are not necessary in laying Asphalt Bridge Plank.

**Best Performance under Heavy Traffic:** The continuous action of traffic develops the plank into a smooth, "live" wearing surface.

### Application of Asphalt Plank

Because it is more or less plastic, Asphalt Bridge Plank must be stored on a flat surface to prevent sagging. Once laid, however, it will not warp or twist. It can be cut with an ordinary hatchet or chisel.

Over wood or concrete decks, J-M Asphalt Bridge Plank is applied in J-M Asphalt Plank Cement (cut back type) furnished in various-sized containers. This cement ordinarily covers 40 to 50 sq ft per gallon.

Over wood decks the plank may be nailed if necessary in addition to cementing, the primary purpose of the nailing being to force the plank down into the cement. Nails are countersunk and the ironing action of traffic soon locks them firmly in place. Over creosoted wood decks a layer of 1-oz "Electro-Sheet" copper

is first tacked to the deck and the plank then cemented and nailed in the usual manner.

Because a close end and side fit between planks is desirable, pressure must be applied to the side and end when laying the material. Stop plates or structural steel angles, on lift bridges particularly, may be fastened transversely across the deck at necessary intervals to hold the planks in place. Owing to the tendency of the copper sheets to interfere with fastening the plank to the deck, stop plates should be used, spaced from 5 to 20 ft depending upon conditions.

### Asphalt Bridge Plank on Railroad Bridges

On ballasted deck railroad bridges, the waterproofing is usually a built-up membrane of felts or fabric laid in asphalt. Such a membrane requires protection from puncturing by the ballast.

Smooth-Surfaced Asphalt Bridge Plank meets such requirements and at the same time is, in itself, sufficiently waterproof to form an addition to the waterproofing element as well as serving as a protection. The plank may be laid in the top mopping at the time the membrane is applied and the ballast laid as soon as the planks are laid. The usual thickness of plank is  $1\frac{1}{4}$ ".

## J-M Felt-Sided Expansion Joint

J-M Felt-Sided Asphalt Expansion Joints are used in concrete runways, streets and highways wherever an expansion joint is necessary. They are composed of a bituminous core, principally asphalt, confined between two sheets of felt. Supplied in slab form or cut to size and in thicknesses of  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1". The net weight of this material is 5.7 lb per board foot, and standard dimensions are 10 ft long and up to 36" widths.

**Installation Methods:** J-M Felt-Sided Expansion Joint may be installed in concrete highways in accordance with conventional methods for the installation of expansion joint. In general, expansion joint materials require a supporting device such as a bulkhead or, in some instances, a metal channel cap which functions not only as a bulkhead but also forms a protection for the joint material where it is exposed at the surface of the paving.



Depending upon dowel construction, there are various special devices for installing expansion joint and holding the dowels. Bulkheads and installation devices are removed after the concrete has been placed and before it has attained its initial set. The exposed edges of the concrete along the joint material are then finished or "edged" to prevent spalling and to add to the appearance of the completed joint.



## Terraflex Tile Flooring



*For offices, Terraflex harmonizes with any type of interior, provides comfort under foot, and is easily kept clean and bright; advantages not often found together in any other one type of flooring*

Terraflex, a plastic asbestos floor tile, possesses many advantages unobtainable in any other type of resilient floor. It is characterized by a softness under foot and a vividness and warmth of color unmatched by other floor coverings.

Furthermore, it retains all the sturdy advantages of the long successful J-M Standard Asphalt Tile, chief of which are resistance to fire, indentation resistance, wearability, moisture resistance, ease of care and maintenance.

Terraflex has remarkable color stability. Colors look equally attractive whether under fluorescent or incandescent lighting, an advantage that makes Terraflex a natural choice for such locations as smart dress and speciality shops, cocktail lounges and lobbies.

Its grease and oil-proof characteristics assure satisfactory performance in drug stores, kitchens, restaurants, bakeries, and manufacturing areas. Ease and low cost of maintenance make the use of Terraflex doubly desirable in offices, reception rooms, schools, hospitals and similar institutions.

The following qualities illustrate why Johns-Manville Terraflex is the nearest approach to a universal all-purpose flooring so far developed.

**Alkali Resistance:** Highly alkali resistant both with respect to the pigments employed and the resin base. So far as resistance to alkaline cleansing agents and alkaline moisture on basement floors are concerned, Terraflex is far superior to the ordinary types of resilient floorings, including asphalt tile.

**Wear Resistance:** Tests show two to three times the resistance of standard asphalt tile, previously considered the longest wearing of all resilient flooring.

**Fire Resistance:** Very resistant owing to the high asbestos fiber content and will not support combustion.

**Indentation Resistance:** Designed to come within the approved range of the Federal Specifications for asphalt tile.

**Skid Resistance:** Meets all the tests for the various types of unwaxed resilient floorings under both dry and wet conditions.



**Acid Resistance:** Adequately resistant to all organic acids ordinarily contacted and to dilute solutions of mineral acids. Terraflex is superior to other types of resilient floorings for laboratory, lavatory and other floor areas generally exposed to mild acids.

**Water Resistance:** Highly resistant to water and alkaline moisture, Terraflex is the only resilient flooring, with the exception of asphalt tile, to perform satisfactorily on concrete slabs in direct contact with the ground.

**Resistance to Common Hospital Solvents:** Adequately resistant to all the hospital solvents ordinarily contacted. In regard to the common hospital solvents such as benzol, carbon tetrachloride, chloroform and acetone, Terraflex is considered superior under normal hospital working conditions.

**Range of Color:** The most brilliant and clearest colors can be reached with Terraflex tile.

**Light Reflection:** Tests show that light-colored base tile (base color yellow or gray) have reflection values of approximately 10 times those of dark-base tile (base color black); and red, brown, and green base-colored tile show values of approximately four times those of dark-base tile (base color black).



*Terraflex is not harmed by mild acid solutions and disinfectants commonly used in hospitals*

### Colors and Sizes

Terraflex Tile is available in the colors shown below and in sizes 9" x 9", and 12" x 12",  $\frac{1}{8}$ " and  $\frac{1}{16}$ " thick. Weight per sq ft,  $\frac{1}{8}$ " thick, is approximately 1.2 lb.

Style	Color No.	Color Description
Plain	91*	Black*
Marbleized	902	Penguin Black**
"	903	Snipe Salmon
"	904	Falcon Brown
"	906	Gull Gray
"	907	Mallard Green
"	911	Dove Gray
"	915	Parrot Green**
"	921	Cardinal Red**
"	923	Sandpiper Tan
"	926	Canary Yellow**
"	927	Egret White**
"	930	Jay Blue**
"	944	Thrush Brown
"	945	Swallow Green
"	946	Heron White

\* Available in 18" x 24" size only. \*\* These colors, without marbleizing, are available in Feature Strips,  $\frac{1}{8}$ " thick, 1" to 3" wide (in multiples of  $\frac{1}{2}$ " by 24" long; also Terraflex Inserts.

### Care and Maintenance

Resiliency and comfort are advantages in Terraflex Tile Flooring which are lacking in hard floors. Since Terraflex is resilient, it should receive proper care to protect its appearance and prolong its wear. Sharp point loads of furniture or equipment or heavy static loads require protection to avoid indentations in the Terraflex tile.

**Care:** Light weight furniture such as side chairs, light cabinets, etc., that is often moved, should be equipped with glides having a smooth flat base with rounded edges. Sizes of glides, dependent upon the weight, range from 1" to 2 $\frac{1}{2}$ " in diameter. Small metal domes should be removed and replaced with the flat



*Terraflex flooring takes the daily punishment of thousands of scuffling feet aboard this large ferry. The flooring serves for both lower and upper decks. Similar services include railroad passenger cars*



glides. Tables and heavier furniture not frequently moved should be equipped with "furniture cups." Desk chairs and other furniture that is frequently moved should be equipped with easy swiveling, ball-bearing, wide-wheel casters or flat glides. Caster wheels should be 2" or more in diameter with wide, flat, soft rubber composition tread; never use small diameter, narrow, hard wheel casters and metal domes.

**Cleaning and Waxing:** While Terraflex may be cleaned in the same manner as linoleum and similar soft floor coverings, J-M Floor Cleaner is recommended for best results. This cleaner requires no hard rubbing and deposits a slight film of wax as it cleans. However, the application of J-M Self-Polishing Floor Wax in addition to the "cleaner" provides a high, glossy finish with maximum resistance against damp-mopping, spill-



For restaurants and cafeterias, Terraflex combines rich color and design with quietness under foot and ease of maintenance age, and tracking. Varnish, lacquer, shellac or other plastic finishes should never be used.

*Terraflex Tile Accessories (Approx. Wt and Sq Ft)*

Name of Product	Description of Product	Sq ft per gal	Wt, lb per gal	Container sizes, gal
Type B Asphalt Tile Cement	An emulsified asphalt for installation of Terraflex Tile on asphalt-saturated felts over wood floors and on Asphalt Emulsion or Latex Underlayment.	125	8¼	1, 5
Type C Asphalt Tile Cement	A cut-back asphalt recommended for all installations over concrete sub-floors and particularly for on-grade or below grade installations. This cement must never be used on asphalt-saturated felts or on Asphalt Emulsion Underlayments.	200	8¼	1, 5
Type D Grease-Resistant Asphalt Tile Cement	A cut-back resinous adhesive for cementing Terraflex Tile directly to concrete sub-floors wherever there is a severe oil or grease condition.	140	8½	1, 5
Cut-Back Primer	A thin, liquid asphalt for priming dusty or chalky concrete sub-floors.	300	7¼	1, 5
Fibrated Flooring Asphalt (Underlayment)	An asphaltic compound used with portland cement, sand and water for leveling fills.	*	8½	5
Emulsion Primer	An emulsified asphalt used for priming concrete and other sub-floors to receive underlayment.	85	8¼	5
Terraflex Adhesive	A brush-on type of adhesive for application over underlayment.	250	7	1
Vinyl Cove Base	A flexible cove base, set-on type, in black only, 4" wall flap x 48" x ⅛".	—	—	—
Asphalt Cove Base	A flexible cove base, set-on type in black or dark red, 4" or 6" wall flap x 24" x ⅛".	—	—	—
Asphalt Cove Base Cement	A heavy-bodied asphalt cut-back adhesive for installing Asphalt Cove Base on all suitable wall surfaces.	80	9	1, 5
Latex Underlayment (Emulsion and Primer)	A combination emulsion and powder for underlayment over rough wood or concrete sub-floors.	**	—	—
Latex Emulsion	See Above.	**	8	5
Latex Powder	See Above.	**	—	80-lb bag
Asphalt-Saturated Felts	Asbestos and Rag Felts for use over wood floors.	—	—	—

\* A fill mixture per 110 sq ft, ¼" thick, or 90 sq ft, ⅜" thick, requires 7½ gal.

\*\* One 5-gal pail of the Emulsion and two 80-lb bags of the Powder will produce sufficient material to cover approximately 300 sq ft, ⅛" thick.





*Terraflex is particularly suitable for libraries, combining quietness under foot with excellent light reflection*



*The wearability of Terraflex makes it particularly suitable for corridors and service lobbies*



*The soft resiliency, durability and easy cleanliness of Terraflex make it the outstanding floor material for children's playrooms*



## J-M Asphalt Tile Flooring



*This installation of J-M Asphalt Tile Flooring in one of the halls of a large college assures an attractive, permanent and resilient floor which is safe and easily cleaned*

Whether the need is for a richly decorative floor or one that is strictly utilitarian, J-M Asphalt Tile Flooring meets all of the seven important requirements of a desirable floor covering:

1. Fine appearance
2. Low cost
3. Marked durability
4. Resistance to moisture and fire
5. Comfort, sanitation and safety under foot
6. Minimum maintenance expense
7. Ease of repair or extension

### *Appearance:*

With the great variety of colors and patterns available, any desired effect is easily obtained—bright and cheerful, dark and rich, gay or unobtrusive. The harmony of the extensive line of colors permits them to be used together with the utmost freedom in any pattern or combination selected, with the assurance that the resulting effect will be pleasing to the eye and

perfectly suitable whatever the scheme of interior decoration or location. The full lustre of J-M Asphalt Tile is enjoyed immediately after installation because the units are pre-waxed at the factory.

### *Low Cost:*

The first cost of a Johns-Manville Asphalt Tile floor compares favorably with other resilient floor coverings of the same thickness, while its extraordinary service over years with minimum upkeep demonstrates its outstanding economy.

### *Durability:*

The toughness, resistance to abrasion and maintained durability of J-M Asphalt Tile Flooring under the hardest usage in busy locations has been proved in hundreds of installations. Its surface does not become dull with use and years of foot traffic only bring out its lustre.





*Attractive, streamlined, diamond effect in three contrasting colors distinguishes this J-M Asphalt Tile floor*

#### **Resistance to Moisture and Fire:**

By the very nature of its composition, J-M Asphalt Tile is more resistant to moisture than other resilient floor coverings. The method and materials used insure a permanently effective bond between the flooring and the sub-floor when application is made in accordance with manufacturer's directions. After installation, the asphalt tile is fire-retardant and has been officially approved for use in fire-proof buildings in many large cities throughout the country.

#### **Comfort, Safety and Sanitation:**

The resiliency of J-M Asphalt Tile Flooring is immediately perceptible. It cushions hard heels and makes for quiet foot traffic. It is also a safe floor, because the asphalt tile does not wear slippery with use. It is odorless, non-absorbent and will not originate dust. This, with its ease of cleaning, makes it particularly adapted to locations where high sanitary standards must be maintained, such as hospitals, schools and sanitariums. Building managers especially recommend J-M Asphalt Tile Flooring for all types of institutional structures.

#### **Minimum Upkeep:**

J-M Asphalt Tile, due to its toughness, resistance to abrasion, and its natural sheen, does not require expensive treatment and constant attention to preserve the appearance and life of the floor.

The floors of offices, hospitals and other buildings exposed to normal foot traffic, can be maintained clean and attractive by the usual daily brushing and an oc-

casional cleaning with an approved neutral soap. For the floors of street-level shops, restaurants, etc., an occasional waxing with an approved emulsion wax will make the asphalt tile easier to clean when exposed to dirt and grit. Where highly polished floors are desired, the natural sheen of J-M Asphalt Tile permits a high lustre to be obtained, easily and economically, by the use of an approved water wax.

#### **Ease of Repair or Extension:**

When excessive abuse or severe accident makes a repair necessary, new units can be easily inserted to replace the old. The same is true where partition removals or office changes require an extension of the asphalt tile flooring in the same pattern.

#### **Description of J-M Asphalt Tile**

J-M Standard Asphalt Tile is available in a large variety of plain and marbled colors to meet every decorative need and in sizes and thicknesses to meet a wide variety of service or installation requirements.

In the marbled colors, the base or field colors is blended with either one or two colors to produce an unusual and attractive effect. Since the mottling of no two asphalt tile in the same color combination can be exactly alike, a floor laid with J-M Marbled Asphalt Tile shows a freedom from repetition ordinarily lacking in marbled designs.

J-M Greaseproof Asphalt Tile, available in marbled colors only, should be used in areas such as kitchens and restaurants subject to spillage of animal or vegetable fats and oils, and in industrial locations exposed to lubricating or cutting oils.



*Long-wearing J-M Asphalt Tile was chosen for this attractive floor in a busy cocktail lounge*



**Colors:** The plain and marbled colors in which J-M Standard and Grease-Resistant Asphalt Tile are supplied are shown in the table below, followed by an explanation of the groupings within the table.

### Standard Asphalt Tile

Group	Style	No.	Color Description
A	Plain	1	Black
		3	Dark Red
		Also Feature strips	
B	Marbled	102	White on Black
		104	Red, Gold on Dark Red
		112	White, Green on Black
		119	White, Gold on Dark Red
		136	Red, White on Dark Red
C	Plain	137	Red, White on Black
		23	Green (feature strip only)
		103	White, Gold on Rose
		111	Black, White on Gray
		121	White, Gold on Terra Cotta
C	Marbled	139	Black, White on Med. Gray
		140	White, Green on Light Green
		141	Brown, White on Sand
		142	White, Dark Gray, and Coral on Gray
		143	White, Black on Red
D	Plain	144	White, Tan on Brown
		145	White on Green
		33	White
D	Marbled	34	Cream
		35	Bright Red
		Feature strips only	
D	Marbled	126	Red, Gold on Cream
		127	Black on White
		130	White, Black on Lt. Blue
		131	White on Bright Red
		146	Green on White
		147	White, Brown on Yellow

### Grease-Resistant Asphalt Tile

Style	No.	Color Description
Plain	GR-1	Black
Marbled	GR-102	White on Black
	GR-111	Black, White on Gray
	GR-119	White, Gold on Dark Red
	GR-121	White, Gold on Terra Cotta
	GR-141	Brown, White on Sand
	GR-145	White on Green

Because of the wide variance in cost of raw materials entering into the manufacture of the different colors, prices of J-M Standard Asphalt Tile vary with the color and style of the finished product. Therefore, colors are arranged in groups. Standard Asphalt Tile within a group costs the same, but the prices of the groups graduate, as listed in the table above, from the lowest, group A, up to the highest, Group D. J-M Grease-Resistant Asphalt Tile is slightly higher in price than the highest price group of Standard Asphalt Tile.

**Sizes and Thicknesses:** Standard sizes are 9" x 9" and 12" x 12" except style GR-1 supplied 18" x 24" only. Style numbers 1, 3, 102 and 119 supplied 18" x



Many years of service and low maintenance cost are the reasons J-M Asphalt Tile Flooring is extensively used in schools

24" as well as standard sizes. Thicknesses are  $\frac{1}{8}$ " and  $\frac{3}{16}$ ". Weights per sq ft of these units are approximately 1.2 lb and 1.8 lb for  $\frac{1}{8}$ " and  $\frac{3}{16}$ " thicknesses, respectively.

### Application of Asphalt Tile

J-M Asphalt Tile Flooring must be installed over suitable sub-floors in accordance with manufacturer's instructions. Complete directions appear on other data sheets (DS Series 145).

### Asphalt Tile Flooring Accessories

Accessories for use with J-M Asphalt Tile Flooring consist of Feature Strips, Asphalt Cove Base, Cements, Underlayments, Emulsions, and Cut-Back Primers.

**Feature Strips:** Feature strips are available  $\frac{1}{8}$ " and  $\frac{3}{16}$ " thick, cut in widths of 1" to 3" (in multiples of  $\frac{1}{2}$ ") and 24" long. These feature strips are generally used with contrasting colored asphalt tile units to produce attractive panel patterns.

**Asphalt Cove Base:** Flexible Asphalt Cove Base, set-on type, is furnished in black and dark red only, 4" or 6" wall flap x 24" x  $\frac{1}{8}$ ". The cove has a  $\frac{1}{2}$ " radius and the lip is feather-edged, which permits it to rest tightly against the flooring surface. It is used when desired, to replace the usual wood trim base board.

**Edging Strips:** Strips available 1" wide and 18" long,  $\frac{1}{8}$ " or  $\frac{3}{16}$ " thick, in black and red colors only.

### ASPHALT TILE FLOORING AND ACCESSORIES

April, 1953 (Cancelling sheet dated August, 1950)

BMF-401



*Cements, Underlayments and Primers (Approx. Wt and Sq Ft)*

Name of Product	Description of Product	Sq ft per gal	Wt, lb per gal	Container sizes, gal
Type B Asphalt Tile Cement	An emulsified asphalt for installation of Asphalt Tile on asphalt-saturated felts over wood floors and on Asphalt Emulsion or Latex Underlayment.	125	8¼	1, 5
Type C Asphalt Tile Cement	A cut-back asphalt recommended for all installations over concrete sub-floors and particularly for on-grade or below grade installations. This cement must never be used on asphalt-saturated felts or on Asphalt Emulsion Underlayments.	200	8¼	1, 5
Type D Grease-Resistant Asphalt Tile Cement	A cut-back resinous adhesive for cementing Grease-Resistant Asphalt Tile directly to concrete sub-floors wherever there is a severe oil or grease condition.	140	8½	1, 5
Cut-Back Primer	A thin, liquid asphalt for priming dusty or chalky concrete sub-floors.	300	7¼	1, 5
Fibrated Flooring Asphalt (Underlayment)	An asphaltic compound used with portland cement, sand and water for leveling fills.	*	8½	5
Emulsion Primer	An emulsified asphalt used for priming concrete and other sub-floors to receive underlayment.	85	8¼	5
Asphalt Cove Base Cement	A heavy-bodied asphalt cut-back adhesive for installing Asphalt Cove Base on all suitable wall surfaces.	80	9	1, 5
Latex Underlayment (Emulsion and Powder)	A combination emulsion and powder for underlayment over rough wood or concrete sub-floors.	**	—	—
Latex Emulsion	See Above.	**	8	1, 5
Latex Powder	See Above.	**	—	32, 80-lb bag

\* A fill mixture per 110 sq ft, ½" thick, or 90 sq ft, ¾" thick, requires 7½ gal.

\*\* One 5-gal pail of the Emulsion and two 80-lb bags of the Powder will produce sufficient material to cover about 300 sq ft, ¼" thick.

**Protection and Maintenance**

Resiliency and comfort are advantages in J-M Asphalt Tile Flooring which are lacking in hard floors. Since J-M Asphalt Tile Flooring is resilient, it should receive proper care to protect its appearance and prolong its wear. Sharp point loads of furniture or equipment or heavy static loads require protection to avoid indentations in the asphalt tile. Office swivel chairs, beds and the like, should be equipped with ball-bearing casters with wide soft-rubber treads. Heavy stationary furniture should have rubber cups beneath the legs. Portable furniture should be equipped with glides or rubber sleeves. Metal domes are not suitable as they tend to point the load.

The customary maintenance given to linoleum and similar soft floor coverings is all that is necessary to keep J-M Asphalt Tile Flooring in good condition. Warm suds of an approved neutral cleaner, such as J-M Floor Cleaner, can be used to clean the asphalt tile without injury to the material. Soap powders which

contain fillers not readily soluble should not be used, as they may leave a white sediment in the joints between the asphalt tile, and are so strong and harsh they destroy the lustre on the surface of the asphalt tile, rather than improve its appearance.

If a highly polished floor is desired, this may readily be accomplished by the use of J-M Self-Polishing Floor Wax or other approved emulsion wax. Waxes containing solvents such as benzine, turpentine, or other solvents of this type, should not be used for the reason that the solvents will soften the asphalt tile and "run the colors" of one asphalt tile into the other.

Varnish, lacquer, shellac or other plastic finishes should never be used on J-M Asphalt Tile since they usually contain solvents that will permanently injure the asphalt tile. These finishes, furthermore, eventually yellow with age and wear off in traffic lanes so that the yellow film must be removed from the balance of the floor with strong alkali or solvents injurious to the asphalt tile.







BLDG. MATLS. MISC.



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BUILDING MATERIALS, MISCELLANEOUS—INDEX



# Spintex Home Insulation

Spintex® Home Insulation consists of special grades of rock wool for retarding heat flow through walls, ceilings and floors of frame houses. Its purpose is to assist in keeping buildings warm in winter and cool in summer, thereby providing greater comfort with lower fuel bills and, where air-conditioning is used, reduced operating costs. Home Insulation is lasting, fireproof, non-conductive of electricity, and does not nourish vermin. Moreover, the insulation will not attract moisture from the air. Its efficiency is maintained throughout the life of the building structure.

## The Utility of Insulation

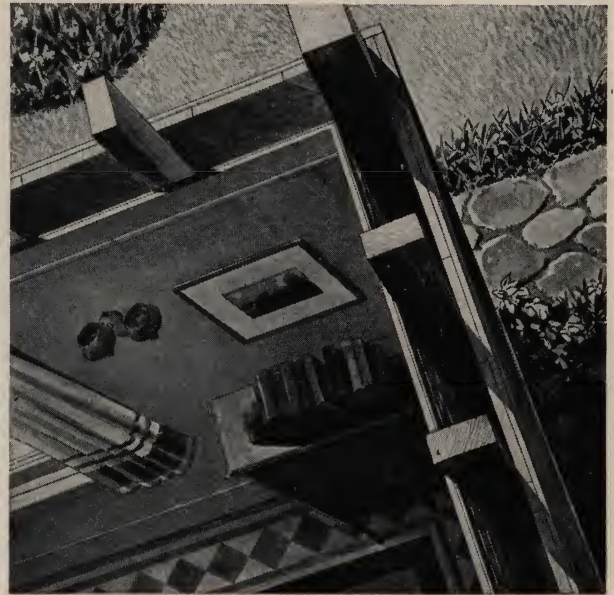
Heating systems vary in efficiency. One system may heat a house with less fuel cost than another system, under like conditions of service, but the gain or loss by the use of either system is but a small amount when compared with the saving or loss due to the type of house construction employed. This factor is often overlooked when heating systems are being planned.

A pound of coal contains from 12,000 to 14,500 Btu. When this is burned in the average domestic heating system, it has been estimated that about 40 percent is lost because of imperfect combustion, etc. The remaining 60 percent goes to heat the house and it is from this that the saving is made.

The term "dead air space" was formerly in common use as applying to the hollow space in building walls, and the popular impression was that this prevented heat transmission something like the space in the walls of a thermos bottle. It has been conclusively proved, however, that this notion was fallacious and that a material which contains a great number of small confined air spaces per unit volume is much more effective as an insulator than an empty space in which air currents may circulate.

KINDS of MATERIAL	FEET											
	1	2	3	4	5	6	7	8	9	10	11	12
J-M Home Insulation	1											
Pine Wood	2											
Gypsum Plaster	3											
Brick (dry)	4											
Concrete Blocks	5											
Cement Plaster	6											
Concrete	7											
Stone (limestone and sandstone)	8											

Comparative thicknesses of various walls required to equal insulating value of full-thick Spintex home insulation



*These hollow walls offer little resistance to the flow of heat. During the summer, they allow outside heat to seep into the cooler interior; in cold weather, furnace warmth is wasted to the outdoors. Home Insulation, filling these hollow spaces, would present a barrier to this flow*

It is obvious that the most practical method of home insulation is to fill the area in the walls of a house with a material containing these minute air spaces. Johns-Manville does just this with Spintex.

The roof or attic floor of any home can be insulated, as can also the walls of any frame house, whether of stucco, clapboard, shingles, brick or stone veneer. The form in which rock wool is applied depends on whether the house is already built or is being constructed.

## The Advantage of Insulation

Home Insulation is an investment which begins to pay dividends as soon as it is installed. The immediate benefits include the following:

- Increase in Home Comfort
- Addition to Property Value
- Improvement of Health Conditions
- Reduction in Decorating Costs
- Reduction in Fuel Costs
- Lower Cooling Costs
- Decrease in Furnace Operation
- Aid in Fire Prevention

A more detailed description of these advantages is given in subsequent paragraphs on the following page.

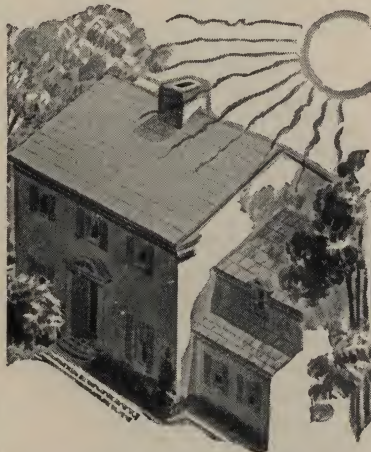


### ***Increases General Home Comfort:***

(a) Warmer in winter. No rooms "hard to heat" are found where an adequate heating system is installed in a house which is insulated with Spintex.

(b) Cooler in summer. The upper floor rooms can be kept at a temperature close to that of the lower floors. Indoor temperatures will sometimes run as much as 15 deg F lower than the outside temperature during the heat of the day.

(c) Attic space, used for storage, can be made into extra bedrooms, play rooms, etc.



*In summer, the sun often heats roofs up to 150 deg F. The roof re-radiates this heat throughout the house unless home insulation prevents such action*

### ***Adds to Property Value:***

House insulation has received wide publicity in the past few years through advertising, government reports, magazine articles, etc., and it is safe to predict that in the near future an uninsulated house will not be considered a good investment.

### ***Improves Health Conditions:***

(a) Frame walls, if uninsulated, usually permit air infiltration in large quantities, resulting in drafts. Heat exchange next to such walls also sets up air currents or drafts within the room.

(b) Ventilation is under more positive control in the case of the insulated house.



*Cold, north winds are frequently the cause for drafty and hard-to-heat rooms. Insulation between the walls will do much to correct these conditions*

### ***Reduces Decorating Costs:***

In winter, insulation minimizes streaking and lath

markings of interiors by keeping ceilings and walls at a uniformly warm temperature.

### ***Reduces Fuel Costs:***

A survey covering a large number of individual cases indicates that for an average insulated house of six to eight rooms, an annual saving of 20 to 30 percent of the fuel bill may be expected. These figures may safely be taken as a fair average, although numerous examples of greater savings have been recorded.

*In cold weather, snow melting on a roof is an indication that furnace heat is being wasted. Home Insulation, completely surrounding the living quarters of a house, will act as a barrier to this outward flow of heat and will reduce fuel cost*



### ***Decreases Furnace Operations:***

Because the heat loss from an insulated building is greatly reduced the furnace does not have to be fired as hard as before. Through judicious use of fireplaces, cookstoves, and auxiliary heaters during the chilly days of spring and autumn, the seasonal use of the furnace may be materially reduced. With reduced furnace operation there is a consequent saving of labor in the handling of fuel and ashes. In addition, the heating plant will require considerably less attention because of the ease of uniformly maintaining comfortable temperatures.

### ***Aids in Preventing Fires:***

The average frame house, due to its construction, is a fire hazard. Filling the walls and ceilings with a fireproof insulating material lessens the possibility of the house catching fire from overheated flues because furnace "forcing" then becomes unnecessary. Furthermore, as long as the insulation is in place, it will prevent the passage of flame between the walls.

As a matter of fact Spintex Home Insulation is regarded as such an excellent fire stop that its use has been approved as a fire retardant in multiple dwellings.



## Spintex Type A Home Insulation



*Blowing machines housed in trucks install Type A Home Insulation pneumatically. This method of application minimizes dust and disturbance in the interior of the home*

Spintex® Type A Home Insulation, used for insulating the walls and attics of existing homes, is nodulated rock wool, which, when blown into the walls and attic spaces with compressed air, fills every space with heat-resistant material. This method is the only practical way of insulating houses already constructed, whether of wood, brick or stone veneer, or stucco.

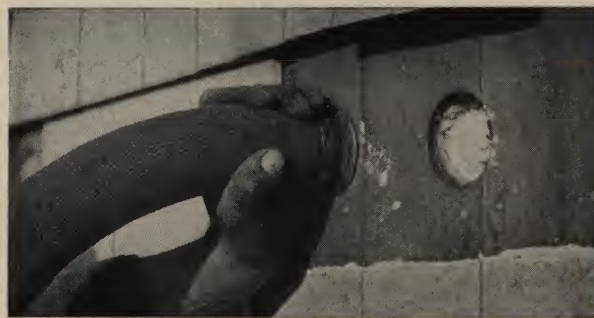
Proper application is just as important in insulating existing homes as is the material itself. For this reason, Johns-Manville has established in convenient locations Approved Home Insulation Contractors who have the proper equipment and who can qualify in experience and business integrity to carry the J-M franchise. These companies are equipped to furnish and install Home Insulation to meet the high standard required by their franchise.

The insulation work, for the most part, is done from the outside with a minimum of litter, dust or disturbance inside the house. The usual home activities continue without interruption and shrubs, trees and lawns are unharmed. All work is done by well-trained, experienced, courteous men.

The Home Insulation is furnished in printed paper bags containing approximately 40 lb and is applied

uniformly to fill the entire stud space. In most cases, it is recommended that all exterior walls above the foundation wall, roofs, ceilings, attics, garages and other areas be completely insulated.

Home Insulation is blown only at low pressures, usually 2 lb per sq in. or less. The pressure accomplishes two desired effects: It gives a firm, even pack which assures maximum thermal efficiency; and it puts the material under an initial compression so that any subsequent vibration or building movement will not cause the insulation to settle, but, rather, to expand and thus retain its full insulating value.



*Carefully regulated pneumatic pressure forces rock wool into the walls at the proper density*



Openings are made near top of wall panels, and the insulation installed by inserting the nozzle of the hose, which comes from the blowing machine, into each hole and blowing the material into the panel. Before the work of blowing starts, soundings are made with a plumb bob to locate cross framing. Where such framing is found, additional openings are made to assure that all spaces will be filled.

In insulating the third story of existing houses that have one or more rooms above the ceiling joists of the second floor, it is necessary to get between the roof and the walls of the upper story room and insulate the side walls (knee walls) of the room from behind. This is done by boarding up the back of the studs with



*Home Insulation is usually blown into the walls of a house through holes made in the sheathing. After the installation, the openings are carefully covered and all traces of the work are removed*

a suitable retaining material and blowing behind it. It may be necessary to make an opening in the roof large enough to allow workmen to enter. The entire ceiling, including the portion from the wall line of the eaves to the walls of the third-story room, is insulated by blowing.

It is always important that all portions around windows be insulated thoroughly, as considerable air infiltration takes place around window framing. Insulation should be kept out of window weight space.



*Blowing Home Insulation between the joists of an unfloored attic is easily accomplished*

In the case of open joists on unfloored attics, the man operating the nozzle stands on the joists and sprays the material to the desired thickness between the joists. If the attic is floored, it is necessary to remove a few floor boards and insert the hose between each pair of joists, pushing the hose in as far as necessary to fill the space to the eave line. The material is then blown and as the space fills up to the required depth, the hose is slowly withdrawn.

All expansion tanks, water tanks, or pipes above an insulated attic floor must be carefully insulated, as they are subject to freezing upon completion of the insulation of the top floor ceiling.



*In a floored attic, only a few boards are removed to gain access to the entire area to be insulated*



## Spintex Home Insulation—Batts and Blankets



*When Spintex is used considerable saving is made in installation costs because of less time involved in cutting and handling the material. The felted structure does not break down even when twisted and bent*

Spintex® Home Insulation is the result of a new and originally developed J-M manufacturing process. The insulation is made from unusually long and extremely fine mineral wool fibers, prefabricated to a scientifically determined density and thickness. Whether used in batt or blanket forms, Spintex provides maximum insulation efficiency for both sidewall and attic applications. Also, the added strength and resiliency of the products assures greater economy and speed in installation.

### Spintex Batts

**Spintex Is Easier to Handle:** The batts can be lifted from the containers without their breaking and they can be bent excessively without any damaging effect. Eliminating the requirement of careful handling reduces the time required for application.

**Easily Cut:** When batts must be fitted around pipe or into odd-shaped areas, a clean, even cut can be secured by merely using a reasonably sharp knife.

**Patching Eliminated:** Because Spintex springs into proper and uniform thickness soon after being released from the containers, thin spots and heat-leaking voids in the insulation are eliminated. This ends time-consuming patching often necessary with insulation not as resilient as Spintex.

**Storage Costs Reduced:** The resiliency of Spintex enables the batts to be compressed for packaging, but springing to full thickness when opened. As a result, ten instead of eight Ful-Thick Batts are supplied per package—a saving of 25 percent on handling—25 per-

cent more packages of insulation per truck or carload.

**Description and Sizes:** Spintex batts are manufactured with a vapor seal paper adhered to one face, covering the entire surface and extending 1½" on the long sides of the batt. These 1½" laps, neatly folded against the membrane backing in manufacture, are turned out and tacked or stapled to the studs, rafters or joists in application. The paper backing helps to prevent the passage of vapor and resists the penetration of moisture from excess water in fresh plaster.

The structural strength of Spintex makes it difficult to pull the mineral wool fibers apart. This fact provides assurance that the backing, which is securely fastened to the wool, will not tear off.

Super-Felt batts are furnished Ful-Thick and Semi-Thick. Ful-Thick batts are manufactured with an average thickness of 3¼"; Semi-Thick batts with an average thickness of 2". The 15" x 48" size is especially suitable for attic floors and for sidewalls. The smaller, 15" x 24" batts are particularly adaptable for overhead work.

Size in inches	Batts per package,		Net Area per package, sq ft		Approx Wt per package, lb	
	Ful- Thick	Semi- Thick	Ful-T.	Semi-T.	Ful-T.	Semi-T.
15 x 24	20	40	50.00	100.00	45	53
15 x 48	10	20	50.00	100.00	45	53
19 x 24	20	30	63.30	95.00	57	50
19 x 48	10	15	63.30	95.00	57	50
23 x 24	20	30	76.66	115.00	68	60
23 x 48	10	15	76.66	115.00	68	60

Notes: Actual weights may vary  $\pm$  20 percent. Availability of sizes sometimes dependent upon plant location.



## Spintex Blankets

Processed and fabricated in the same manner as batts, Spintex Blankets are manufactured in three types: Thick Blankets, Medium Blankets and Service Blankets. For ease in handling, the blankets are fully enclosed with permeable kraft paper wrapping and backed with a heavy vapor seal. All have projecting flanges for easy fastening. The approximate blanket thicknesses are as follows: Thick, 3"; Medium, 2"; and Service, 1½".

Size of Blanket	Blankets per Package	Net Area per Package Sq Ft	Approx Wt per Package Lb
<b>Thick Blankets</b>			
15" x 48"	12	60.00	45
23" x 48"	10	76.66	58
<b>Medium Blankets</b>			
15" x 64 ft	1	80.00	43
23" x 64 ft	1	122.66	65
15" x 8 ft	8	80.00	43
23" x 8 ft	8	122.66	65
<b>Service Blankets</b>			
15" x 8 ft	10	100.00	44
23" x 8 ft	10	153.33	63

Notes: Actual weights may vary  $\pm$  20 percent. Availability of sizes sometimes dependent upon plant location.

## Application of Spintex Insulation

Spintex forms a homogeneous mass of fibrous insulation which, when installed, should completely envelop the living quarters of a house. In general, if the attic is unfinished and not to be occupied, it is better to stop the heat flow at the attic floor line instead of at the roof. Spintex, therefore, is installed between studs from the foundation to the roof and between the top story ceiling joists.

When an attic floor makes the above procedure impractical, the insulation should be installed between the rafters, across collar beams at the top of the attic and between the studding at the gable ends. An attic containing a heated room is similarly insulated except that the insulation is installed only to ceiling height of the room and between the ceiling joists.

Whether batts or blankets are used, the vapor seal backing paper must always face the heated area. Spintex is fastened by stapling or nailing the vapor seal



*Ful-Thick Batts of Spintex insulation are quickly stapled or nailed in place through the side flanges*

flanges to the framing members. In every case the insulation should be placed so that pipes will not freeze and adequate ventilation provided in attics and similar spaces. More complete application information is available on separate data sheets.

## Pouring Wool

J-M Pouring Wool, white in color, developed as an accessory item to Spintex batts and blankets, is used for filling the occasional horizontal spaces not readily accessible to batt or blanket application. Pouring wool is supplied in bags of approximately 40 lb.

## Loose Wool

J-M Loose Mineral Wool, white in color, is shipped in bags of approximately 40 lb. It is used for stuffing by hand in inaccessible vertical spaces, such as around vent pipes, etc.



## J-M Insulating Board Products



*The interiors of many churches, new as well as old, have been finished with Glazecoat Ceiling Panels and Wall Plank or J-M Building Board. These products decorate as they build*

The Insulating Board Products of Johns-Manville, as developed and perfected by J-M research engineers, have made a real and lasting contribution to the building industry. These products are made from tough Southern pine fibers processed into a homogeneous board, structurally strong and highly effective as an insulating and decorative medium.

J-M Insulating Board is preformed into a variety of shapes: Building Board and Service Board in large sheets for general use in covering big areas quickly and economically; Ceiling Panels and Wall Plank for economical and decorative ceiling and wall applications; Perforated Fibretex wherever a low cost decorative acoustical ceiling is desired; Insulating Lath for service as an efficient plaster base; Shingle Backer for protection and improved shadow-line appearance behind wood shake shingles; and Weathertite\* Sheathing which serves as a combination insulating and structural sheathing.

### Modern Dry-Wall Construction

For modern and economical "dry wall" interior construction, Ceiling Panels, Perforated Fibretex, Wall Plank, and large Building Boards provide a variety of treatments for almost every room. Cleaning is easy

and the products, if desired, can be painted to match any color scheme. No priming is necessary for the Glazecoat finishes and any good grade of paint may be used when applied in accordance with the paint manufacturer's directions.

### Ceiling Panels and Wall Plank

The J-M Improved Lightning Joint saves time in application as the units almost automatically fit together, quickly and smoothly. No disfiguring nail heads are visible anywhere on the pleasing modern design finish.

In addition, Wall Plank and Ceiling Panels are provided with a flame-resistant Glazecoat finish which passes the requirements established by Federal Specification SS-A-118a, Sect. F-3c. The units are also triple coated, giving a smoother surface and reducing to a minimum any tendency toward color variation. New ingredients in the surface coating make it harder, more durable, and with greater resistance to scuffing and abrasion, but easier to clean.

### Perforated Fibretex

J-M Perforated Fibretex with the improved lightning joint and durable Glazecoat finish is ideal for ceilings of small stores, offices, game rooms, churches and all the small jobs which do not require or justify expensive acoustical treatment.

\* Reg. U. S. Pat. Off.



### Building Board and Service Board

These boards are supplied in large units (max 48 sq ft) with all edges square. They are available in either natural or flame-resistant Glazecoat finish for covering large areas quickly and economically. Service Board, of lesser thickness than Building Board, is used where low cost is a basic consideration.

### Weathertite Sheathing

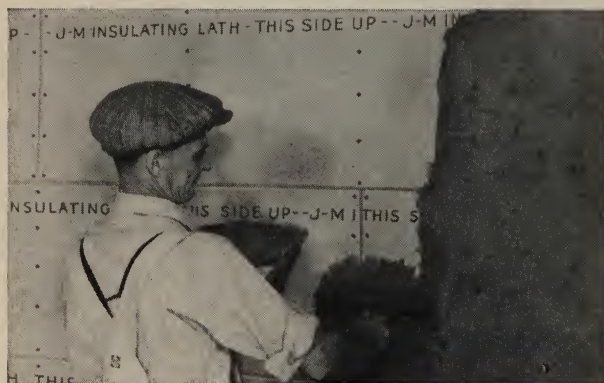
J-M Weathertite Sheathing, integrally impregnated throughout with an asphaltic compound, provides a greater measure of protection against wind and water penetration. It is not a vapor barrier, however, as it permits the passage of moisture vapor. For horizontal application, Weathertite is furnished with the highly efficient "V-Tite" joint, designed to provide maximum resistance to the infiltration of dirt and moisture. Laboratory tests prove Weathertite has greater bracing strength than horizontally applied wood sheathing.

### Shingle Backer

J-M Shingle Backer, an asphalt-impregnated board, is used as an under course in the application of wood siding shingles. It furnishes added insulation and improved shadow-line appearance wherever shake shingles are used.

### Insulating Lath

Insulating Lath not only provides a stronger, more effective bond for plaster but serves as an efficient wall and ceiling insulation. Cracking is reduced to a minimum and unsightly lath marks are eliminated. The plaster can be more easily applied and there is a desirable saving in materials and labor.



*J-M Insulating Lath makes a strong bond with plaster*



*Weathertite Sheathing, highly resistant to distortion, is easily and economically erected*

### Application

Complete instructions for applying J-M Insulating Board Products are given elsewhere. In general the following applies: Ceiling Panels and Wall Plank can be applied over new or existing construction over wood furring; Building and Service Board over framing members, wood furring or other level bases suitable for nailing; Weathertite Sheathing (4-ft wide) is applied with the long dimensions parallel to the vertical framing members, and the 2-ft widths at right angles (horizontally) to the vertical framing members; and Insulating Lath can be nailed directly to framing members or to furring applied over masonry walls.

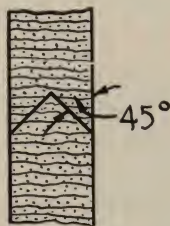
### Other J-M Insulating Board Products

**Roofinsul:** An insulating board product specially impregnated and designed for use as insulation over roof decks, principally under built-up roofs. Complete data is given on separate data sheets.

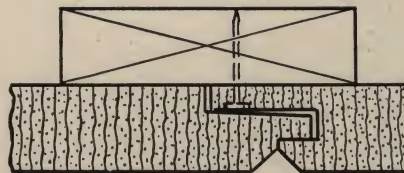
**Insulating Siding:** A popular siding composed of J-M Insulating Board, specially impregnated, as the base sheet with colorful mineral granules firmly bonded on the exposed surface. The siding is supplied in large, economical units in overlap shake-shingle design, brick design, flat-shingle design, and ashlar-stone design, in a choice of attractive color blends. Nailed over old, weather-beaten walls, these large units save time in application and provide savings in maintenance expense and fuel. Appropriate corner pieces are supplied.



Size	Thickness	Finish or Color	Type of Edge, Etc.
Building Board			
4' wide x 6', 7', 8', 9', 10' and 12' long	1/2"	Natural or Flame-Resistant Ivory Glazecoat	All edges square
Service Board			
(4' x 8' only for Natural finish) 4' wide x 6', 7', 8', 9', 10' and 12' long	—	Natural or Flame-Resistant Ivory Glazecoat	All edges square
Weathertite Sheathing			
4' wide x 8', 9' and 12' long;        } also, 2' x 8'                                }	25/32"	Impregnated with asphalt (both thicknesses)	4-ft widths, all edges square; 2-ft widths, short edges square and long edges with V-Tite Joint
4' wide x 8' and 9' long.....	1/2"		
Glazecoat Ceiling Panels			
12"x12", 12"x24" (plain or scored ) 12"x12"), 16"x 16" and 16"x32"    } 16"x16".....	1/2"  3/4"	Flame Resistant White or Ivory Glazecoat (both thicknesses)	Improved Lightning Joint (both thicknesses)
Glazecoat Wall Plank			
Widths: 10", 12" and 16" Lengths: 8', 10' and 12'	1/2"	Flame Resistant Ivory, Antique Green, Dust Rose, and Buckskin Tan Glazecoat Finishes	Improved Lightning Joint on the long edges; short edges square. All plank are beaded
Perforated Fibretex			
12" x 12"	1/2", 3/4"	Standard White Glazecoat	Improved Lightning Joint (both thicknesses)
Shingle Backer			
11 3/4" x 48", 13 1/2" x 48", 15 1/2" x 48"	3/8"	Asphalt Impregnated	All edges square
Insulating Lath			
18"x48"	1/2"	Natural	Short edges, beveled and square. Long edges, beveled and shiplap
Insulating Siding			
11 1/8" x 48" (Shake Design) 15" x 48" (Flat Shingle, Stone and Brick Design) Corner pieces available for all styles	—	Attractive blends such as Red, Buff, Green, Opal Depending upon design used	Brick, Flat Shingle and Ashlar: All edges shiplap 1/2". Overlap Shake Shingle: Top edge square, Bottom and ends shiplap



"V-TITE JOINT"  
WEATHERITE  
SHEATHING



"IMPROVED LIGHTNING JOINT"  
PANELS AND PLANK



"SHIPLAP EDGE"  
INSULATING  
LATH

The types of joints shown above are outstanding features of J-M Insulating Board Products. The "Improved Lightning Joint" provides speedy application and concealed nailing for Ceiling Panels and Wall Plank. The "V-Tite Joint," Weatherite Sheathing, prevents the infiltration of dirt and moisture. And the "Shiplap Edge" of Insulating Lath is a contributing factor in successful plaster application.



## J-M Hard Board Products

J-M Hard Board Products are attractive, unusually tough fiber boards whose many advantages have led to their use in practically every phase of interior decoration. Typical uses include paneling, shelving, counter and table tops, furniture, partitions and magazine racks.

These products have greater density and toughness, are more waterproof, than the wood from which they are made. Their hard, glossy surface is highly resistant to abrasion and wear. Under normal usage, these materials will not crack, split or splinter. Despite their toughness, however, Hard Board Products work easily, requiring nothing more than ordinary carpenters' tools.

If desired, or to conform with special decorative effects, the hard boards can be painted or stained in accordance with the paint manufacturer's instructions.

### Standard Hard Board

Standard Hard Board, with its pleasing, mottled effect and polished surface, is highly attractive in its natural brown color. This material often serves for built-in cabinets, book cases, wainscoting, etc., in conjunction with J-M Insulating Board Products.

### Tempered Hard Board

Tempered Hard Board is Standard Hard Board impregnated with a special compound and baked. The tempering process increases the density and strength. For fine scroll work or intricate machining, Tempered Hard Board works to even a cleaner edge than Standard.

### Black Tempered Hard Board

Black Tempered Hard Board is Tempered Hard Board that has been treated with a black dye in the manufacturing process.

### Scored Tempered Hard Board

Scored Tempered Hard Board is distinguished by score lines which are impressed into one surface forming 4-inch squares. It's very hard surface and low rate of water absorption makes it adaptable for kitchens, bathrooms and wash rooms.

### Embossed Hard Board

Embossed Hard Board, with the same physical properties as Scored Tempered Hard Board, has a pattern that simulates Spanish-grain leather embossed into one surface. Typical installations include offices, lounges, and recreation rooms.

### Perforated Hard Board

Perforated Hard Board is Tempered Hard Board available either with one smooth side (S1S) and one screen side, or with two smooth sides (S2S). The perforations are located on 1" centers. The board is available in the following styles: Perforated Tempered S1S Hard Board, Perforated Tempered S2S Hard Board, Perforated Embossed S1S Hard Board, and Perforated Black Tempered S1S Hard Board.

### PanLboard

PanLboard is similar to Standard Hard Board, but is less dense. It is generally used for surfaces where the hardness of the standard board is not required.

### How Furnished

All J-M Hard Board Products are furnished with square edges only. Beveled or any type fabricated edge cannot be furnished. The thicknesses and sizes are given in the following table. The sheets are always shipped wrapped unless otherwise specified.

Thicknesses, Inches	Standard Sizes, Feet
<b>Standard Hard Board and Tempered Hard Board</b>	
$\frac{1}{8}$ , $\frac{3}{16}$	4x6, 4x7, 4x8, 4x10, 4x12, 4x16
$\frac{1}{4}$	4x6, 4x8, 4x12, 4x16
$\frac{5}{16}$	4x6, 4x12
<b>Black Tempered Hard Board</b>	
$\frac{1}{8}$ , $\frac{3}{16}$ , $\frac{1}{4}$	4x6, 4x12
<b>Scored Tempered Hard Board</b>	
$\frac{1}{8}$	4x8, 4x16
<b>Embossed Hard Board</b>	
$\frac{1}{8}$	4x8, 4x12, 4x16
<b>Perforated Hard Board</b>	
$\frac{1}{8}$ , $\frac{1}{4}$	2x3, 2x4, 2x6, 2x8
(Tempered S2S and Embossed S1S, $\frac{1}{8}$ only)	3x4 4x4, 4x6, 4x8
<b>PanLboard</b>	
$\frac{3}{16}$ , $\frac{1}{4}$	4x8, 4x10, 4x12
$\frac{1}{4}$	4x4, 4x3 (Underlayment)

### Clap Board Siding

Clap Board Siding is Tempered Hard Board furnished with or without a shadow line strip. The siding is available in thicknesses of  $\frac{1}{4}$ " and  $\frac{5}{16}$ ", widths of 12", 16" and 24" by lengths of 96", 112", 128" and 144".



# Transitop

The new, moisture-proof Transitop† adds to the successful history of this product in the building industry. By combining insulation with fire and weather resistance, this unusual wall panel assures complete and positive protection in permanent construction. It provides an effective barrier against heat and cold; and the attractive, smooth, tough finish never requires paint or preservatives of any kind.

Although originally developed for commercial curtain-wall (U. S. Patent No. 2,057,654) construction and special industrial applications, Transitop is now recognized as an ideal product for general building application.

Transitop complies with rigid performance requirements when used in the construction of homes, farm buildings, apartments, utility buildings, as well as curtain walls for large industrial buildings. It is adaptable to special industrial applications where continuous temperatures do not exceed 200 F. In every case, important economies are provided in the design and construction of either interior or exterior walls. Furthermore, it is equally adaptable for use over wood or steel framing.

## Description

Transitop is a complete 4 ft x 8 ft wall unit consisting of an integrally impregnated insulating board core, faced on two sides with a special asbestos-cement board. A waterproof adhesive is used to laminate the insulating core as well as to bond the non-combustible asbestos-cement faces to the core. The adhesive contains no casein or bituminous materials, and is colorless and completely waterproof.

The unit can be cut or shaped with ordinary carpenter tools; nailed without drilling, or drilled for bolts and other types of fasteners. For the production cutting of Transitop, abrasive wheels or carboloy-tipped saws can be used.

## Physical Characteristics . . . Advantages

**Insulation Value:** The wood fiber core of Transitop is integrally impregnated to provide maximum strength and a highly resistant barrier to moisture without appreciably affecting the insulating properties. The conductivity of the core complies with Federal Specification LLL-F-321b-Class A. The conductance of the J-M insulating core and the heat transmission coefficient

† Reg. U. S. Pat. Off.



*Transitop with a core of integrally impregnated insulating board, faced on two sides with a special asbestos-cement board*

coefficients for single-thickness Transitop walls are shown in the following table.

Thicknesses in Inches,		Conductance of Core	Wall Coefficients, ("U" Value)		Surface to Surface Coefficients (Conductance)
Overall	Core		Inside	Outside	
$1\frac{1}{16}$	$\frac{7}{16}$	0.78	0.39	0.47	0.74
$1\frac{1}{8}$	$\frac{7}{8}$	0.39	0.26	0.29	0.38
$1\frac{9}{16}$	$1\frac{1}{16}$	0.26	0.20	0.21	0.26
2	$1\frac{3}{4}$	0.19	0.16	0.17	0.19

(Expressed in Btu per sq ft per deg F per hr.)

**Contraction and Expansion:** The tough, dense special asbestos-cement faces of Transitop possess a very low water-absorption characteristic, resulting in minimum expansion or contraction owing to humidity changes. The linear change, caused by temperature variation, is negligible.

**Moisture Resistance:** Moisture resistance is built into Transitop by the use of an integrally impregnated core which is laminated with a waterproof adhesive. The non-combustible asbestos-cement faces are also



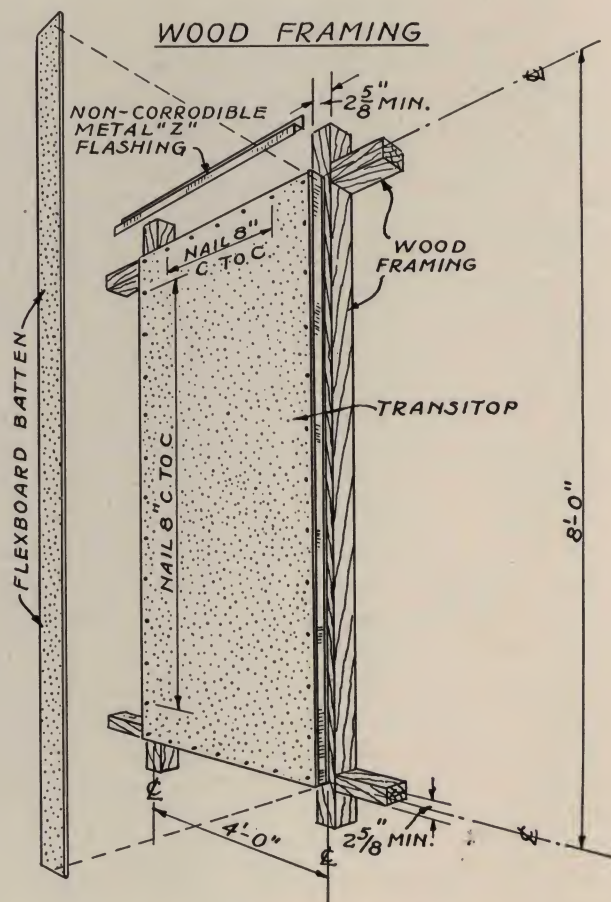
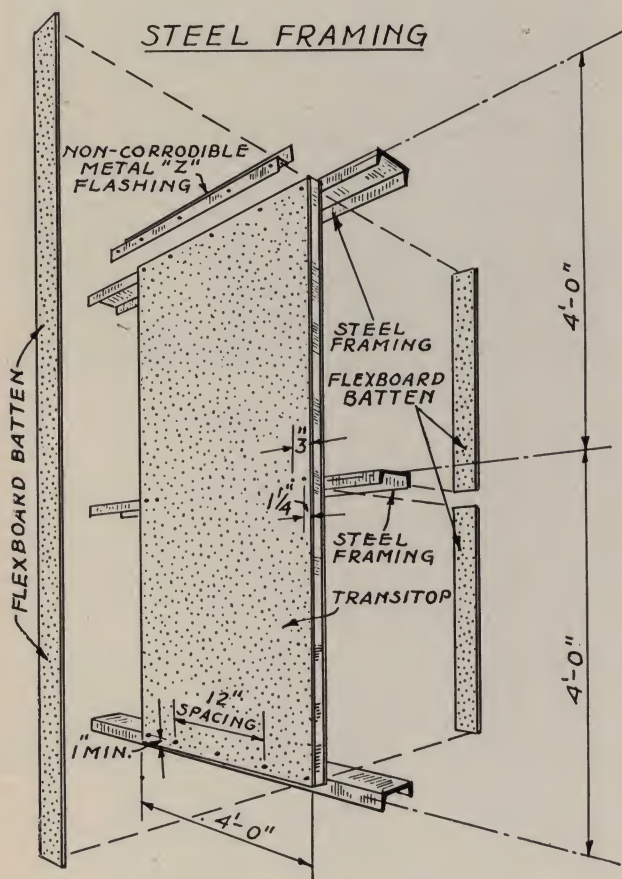
bonded to the core with the same waterproof adhesive, resulting in a product having unusual resistance to rain penetration. It is recommended that where Transi-top is to be used for exterior walls the panel units should be ordered with sealed edges to provide additional protection during shipment and storage prior to application.

**Wind-Load Resistance:** When used for exterior walls exposed to wind pressures, the minimum over-all thickness should be  $1\frac{1}{8}$ ". When installed over supports spaced 4 ft c to c (see drawings below), the assembly will satisfactorily transmit the usual design wind loads of 20 to 30 lb per sq ft.

### Sizes, Weights and Thicknesses

The standard size Transi-top unit is 4-ft wide x 8-ft long, with core thicknesses of  $\frac{7}{16}$ " and multiples of  $\frac{7}{16}$ " to meet individual insulation requirements. On special order, rectangular pieces can be recut from standard sheets.

Thicknesses, in.		Wt per Sq Ft, lb	
Core	Overall	Uncreted	Crated
$\frac{7}{16}$	$1\frac{1}{16}$	3.2	3.7
$\frac{7}{8}$	$1\frac{1}{8}$	3.9	4.6
$1\frac{5}{16}$	$1\frac{9}{16}$	4.6	5.8
$1\frac{3}{4}$	2	5.3	6.7



The above drawings define the minimum framing requirements of Transi-top Wall Panels



## Asbestos Flexboard



*The entire exterior wall surface of this large office building is faced with weatherproof Asbestos Flexboard. The clean, stone-gray sheets are in keeping with the dignified, efficient architectural design*

Over a period of many years, Flexboard® has proved to be one of the most useful and satisfactory building materials ever developed by the Johns-Manville Research Laboratories. Millions of square feet of Flexboard have been utilized with excellent effect for homes, commercial and industrial buildings, farms, and many miscellaneous uses.

Asbestos Flexboard is made of asbestos and cement combined under great pressure, then hydraulically repressed for additional strength and toughness. The result is a dense sheet material which is fire-resistant, rot and corrosion proof, and as permanent as stone. Yet Flexboard is readily workable. It is made in large size sheets to secure economical application, and can be "worked" on the job with ordinary power or hand tools following customary instruction methods. Furthermore, the sheets can be nailed close to the edge without drilling and they possess unusual flexibility in conforming to curved surfaces. Whether for the construction of a new building or over existing surfaces, the sheets can be installed with equal ease.

### Standard Asbestos Flexboard

Standard Asbestos Flexboard, for both interiors and exteriors, is furnished in unpolished sheets of natural gray color. It is not recommended for decorative purposes as there may be slight variations in shade in individual sheets and from one sheet to another.

The sheets are furnished  $\frac{1}{8}$ ",  $\frac{3}{16}$ " and  $\frac{1}{4}$ " thick, in widths of 4 ft by lengths of 4, 8, 10 and 12 ft. The 4 ft x 4 ft and 4 ft x 8 ft sheets are supplied either taped (two to a package) or untaped. All other sizes and thicknesses are furnished untaped. Approximate shipping weights are shown in the following table.

*Approximate Shipping Weights*

Size, feet	Thickness, inches	Weight per 1000 sq ft, lb
4 x 4, 8, 10 and 12	$\frac{1}{8}$	1250
4 x 4, 8, 10 and 12	$\frac{3}{16}$	1875
4 x 4, 8, 10 and 12	$\frac{1}{4}$	2500

Uses: Generally speaking, the fundamental characteristics of Standard Asbestos Flexboard are such that any one, or any combination, of the following qualities suggests a use for this unusually effective, asbestos-cement sheet material: Fire-Resistant, Moisture and Weatherproof, Rot and Corrosion Proof, Vermin Proof . . . all combined with the smooth, hard finish which can be kept sanitary with a minimum amount of effort, time and economy.

Furthermore, the flexibility and workability of Asbestos Flexboard long has placed it in a class with the standard construction methods of ordinary materials. If



desired, Standard Flexboard can be painted for purely decorative effect. Naturally, the painting is not required as a preservative treatment.

*Suggestive Uses for Standard Flexboard*

For lining Walls and Ceilings of:		
Garages	Laboratories	Cafeterias
Furnace Rooms	Kitchens	Offices
Laundries	Bathrooms	Factories
Brooder Houses	Houses	Florist Shops
Dairy Barns	Lavatories	Barracks
Milk Houses	Barber Shops	Military and
Grain Storage	Theatre Lobbies	Naval Structures
Buildings	Bunk Houses	Schoolrooms

For the Construction of:		
Roadside Stands	Aprons Between	Outdoor Dance
Counter Tops	Foundation Piers	Floors
Ventilators	Laundry Chutes	Amusement
Grain Bins	Display Stands	Centers
Range Shelters	Truck Floors	Prefabricated
Hog Houses	Flower Boxes	Houses
Brooder Houses	Bars	Outdoor Signs
Tool Sheds	Outdoor Theatres	Conveyor Housing

**Application:** Complete directions for applying Asbestos Flexboard are given on separate data sheets, and in other descriptive literature. In general the following applies: Flexboard in the  $\frac{1}{4}$ " thickness can be nailed directly to studding or joists spaced on not greater than 24" centers; 16" centers for the  $\frac{3}{16}$ " thickness. The  $\frac{1}{8}$ " thickness should be nailed to a solid backing of  $\frac{3}{8}$ " (min.) thick plywood, wood or composition sheathing. In nailing directly to studding, cats are installed so that all joints are formed over framing members. When used over plaster, suitable nailing grounds are required. The material can be worked with ordinary hand saws, stationery or portable power saws, and is easily "scored" and "snapped" by hand. A special, labor-saving shearing jig is also available.

Standard Asbestos Flexboard can be applied to curved surfaces with the following limitations:

Thickness of sheet	Minimum Longitudinal* Radius	Minimum Transverse** Radius
$\frac{1}{8}$ "	30"	36"
$\frac{3}{16}$ "	36"	54"
$\frac{1}{4}$ "	66"	72"

\* Curvature lengthwise.    \*\* Curvature crosswise.

Flexboard may also be applied with Improved Flexboard Cement, supplemented by nails or other types of mechanical fasteners.

**Painting:** As mentioned, Standard Flexboard is primarily a sheet material in which painting is entirely a



*This curved Flexboard conveyor hood provides protection against weather, fire, rot and corrosion*

matter of decorative effect. In general, painting systems suitable for plaster walls apply for interior surfaces: a suitable primer followed by a good paint in accordance with the paint manufacturer's application directions. For exteriors and for interiors (where severe moisture conditions prevail), a chlorinated rubber paint, applied in accordance with the paint manufacturer's directions, is recommended. Standard "brick and stucco," and regular "house paints" also are satisfactory for the exterior painting of Standard Flexboard. Complete directions for "Painting and Removing Stains from Asbestos-Cement Products" appear on a separate data sheet.

**Asbestos Flexboard Accessories**

**Improved Flexboard Cement:** A special water-proof adhesive used for applying (spot-cementing) Flexboard with supplementary nailing. Supplied in 1-gal containers weighing 10 lb. One gallon covers approximately 225 sq ft.

**Asbestos Flexboard Battens:** The battens are supplied in strips  $\frac{3}{16}$ " thick by 3" and 4" wide and lengths of 4 or 8 feet. They are packaged in bundles containing 96 linear feet.

**Nails:** Non-corrodible, stainless steel drive-screw nails, with either casing or button heads, are used for securing Asbestos Flexboard for interior use. For exterior surfaces, non-corrodible nails of the lead or flat-head type are recommended.



## Celite for Concrete



*In the construction of this bridge, 2 lb or 0.2 cu ft Celite per bag of cement in 1:1.3:2.08 mix was used for piles; slabs were made with 3 lb of Celite per bag of cement in 1:2.3:4.11 mix*

Celite is a specially prepared grade of diatomaceous silica for use in portland cement mixtures. Because it is practically pure amorphous silica, it is a permanent element in concrete, mortar and stucco and does not affect the time of set. It is produced from practically limitless deposits of constant high quality. The milling and manufacturing operations are closely controlled and the production of the material of absolute uniformity is assured at all times. The material is exceptionally light, weighing about 10 lb per cu ft, loosely screened.

Celite is not a substitute for portland cement. It acts rather in the capacity of a microscopic or ultra-fine aggregate which serves to impart plasticity, or workability, and to provide uniformity in portland cement mixtures. By the proper use of Celite, a uniform, homogenous mass of concrete is produced, with increased strength, water-tightness and durability.

Celite has been used with satisfaction in many large projects throughout the United States and other countries. It has the endorsement of the engineer and the architect because of the pronounced improvement in the quality of the concrete. It is of value to the contractor because of its exceptional effect in producing workability, flowing into place in the forms around the most intricate reinforcing.

### *Concrete in Sea Water, Sulphate Waters:*

The value of Celite as a finely divided siliceous material to combine with the free lime, which is

formed as concrete hardens, is particularly emphasized in cases where concrete structures may be subjected to the action of sea water as would prevail in the case of concrete piles, piers, jetties, etc.

The use of Celite is also particularly advantageous in other concrete work which is subjected to sulphates, such as sewage disposal plants, waterworks construction, concrete silos and electrolytic cells, and structures exposed to drainage or irrigation water from sulphate soils.

### *The Use of Celite:*

Celite is furnished in the form of a light-weight powder in extremely finely divided state. No changes in equipment or in methods of mixing and placing concrete are necessary in order to use it. Celite is packed in 50-lb bags for convenient handling and is simply added at the mixer with the other essential dry materials.

### *Amount of Celite which should be added per bag (94 lb) of cement*

Concrete Mix	Range of Use Celite	Recommended Average Celite
1:1½:3	1½-3 lb or 0.15-0.3 cu ft	2 lb or 0.2 cu ft
1:2½:3½	2-4 lb or 0.2-0.4 cu ft	3 lb or 0.3 cu ft
1:2:4	2-4 lb or 0.2-0.4 cu ft	3 lb or 0.3 cu ft
1:2½:5	3-6 lb or 0.3-0.6 cu ft	4 lb or 0.4 cu ft
1:3:6	4-8 lb or 0.4-0.8 cu ft	5 lb or 0.5 cu ft

NOTE: Volume of Celite to be determined on air-dried material fluffed through an 8-mesh sieve.

Celite is added in small percentages by weight but



these small weight additions occupy relatively large volumes. The addition of three pounds of Celite per bag of cement in an average 1:2:4 mix will result

in an increase of from four to five percent in the total volume of the furnished concrete, and lower labor costs in placing and finishing.

## Celite in Mortars, Plasters and Stuccos

Architects and engineers have long recognized the advantages of Celite in improving the quality of mortars, plasters and stuccos. Masonry and plastering contractors also are familiar with the increased plasticity and better working properties brought about by Celite, which is easily handled and requires no change in equipment.

### Effects of Celite

The proper use of Celite in portland cement mortars, plasters and stuccos is effective in correcting the "short working" qualities of these mixtures. Celite acts as an extremely finely divided aggregate when used with a plain cement mortar and provides a working mixture which has a better slip under the trowel, spreads more readily and allows more time for the placing of the brick. The mortar acquires the ability to stand up on the brick, without slopping over, and the joints can be "cut" and "struck" without disfiguring the surface. Stucco and plasters will also have a desirable sharpness of detail and the various textures required for special finishes are most readily obtained.

This plasticity, provided by Celite, is an important factor in the bonding strength of the mortar and the increased impermeability. The addition of the minute, finely divided particles serves to fill the open spaces in the mixture, reducing the void size and effecting a more uniform distribution of the voids. This results in a mortar of greater water-tightness and the consequent ability to offer maximum resistance to extreme weather conditions.

Efflorescence, the white deposit which forms on the surface of many masonry jobs, is more likely to occur with a porous mortar since the soluble salts in the materials used are carried in solution to the surface and left there upon evaporation of the moisture. Water entering through shrinkage cracks may also start efflorescence. Since Celite contains no soluble salts it cannot participate in this efflorescent action. Moreover, it is effective in retarding the formation of these deposits by assuming full, imper-

meable joints, and by providing a mortar in which there is less shrinkage.

### How Celite Is Used

Celite is used in varying proportions in the different mortar, plaster and stucco mixtures, the amounts being determined by the mix itself and by the advantages sought. In general, the recommended averages that follow will prove satisfactory as to strength, cost, appearance and weather-resisting qualities, from the standpoint of the architect, engineer, contractor, and owner. For practical purposes in job measurement, the weight of the loose Celite, may be considered as 10 lb per cu ft.

#### *Cement-Sand Mortars:*

One-half to one cubic foot (5 to 10) of Celite should be used per bag of cement. An addition of 0.6 to 0.8 cu ft (6 to 8 lb) per bag of cement is recommended for the usual 1:3 portland cement mortar mixture. For coarse, washed sand, a larger proportion of Celite can be added to produce the desired working qualities. On many jobs, hydrated lime is added to the mortars to impart plasticity. Celite can also be used with the lime, although no lime is required in mixtures where Celite is used.

#### *Cement Stucco and Plaster Mixtures:*

Celite is added to stucco and plaster mixtures in the same proportion as used in mortars. The following mixes will produce a very satisfactory plaster. For a scratch coat: 3 cu ft clean, sharp sand, 1 bag portland cement, 0.5 cu ft (5 lb) Celite, and sufficient fiber. For a brown coat: The same as for the scratch coat, but without fiber.

#### *Lime and Gypsum Mortar and Plaster*

When lime-sand mixtures are used without cement, the addition of 1 to 1½ cu ft (10 to 15 lb) of Celite per bag of lime will increase the plasticity, spread and strength. Where lime is "over-burned," or where gypsum works "short" or "dead," the use of Celite will produce "fattiness."



## J-M Roof Coatings and Putties

Johns-Manville Roof Coatings and Putties have served for many years as valuable "roof savers" for commercial, industrial, residential, and farm buildings. These products are made from carefully selected ingredients which provide the maximum in penetration, sealing and resistance to varying climatic conditions.

Solvents are used to permit quick penetration and rapid coating of old, dried-out roof surfaces. The solvents employed by Johns-Manville are those which stay in the product during normal application time and then disappear soon enough to prevent running or slumping.

The selected asphalts, consisting of oils, resins and asphaltenes (rock-like particles), do not permit the oils to migrate upward, do not allow the resins to harden quickly, or any of the constituents to oxidize easily.

### Roof Savers

The three principal J-M Roof Savers are Regal Roof Coating and Asbestos Fibrous Roof and Foundation Coating for the roof proper, and Black Plastic Cement for repairing holes or cracks before the application of the coatings.

**Regal Roof Coating:** A smooth-bodied, asphalt coating for roofs which have started to dry out. By applying a coat every two or three years the life of the roof can be materially lengthened at a fraction of the cost of a new roof. Regal Roof Coating is also used for preventing rust and preserving metal roofs, as a surface finish on J-M Bonded Built-up Roofs, and as a valuable adjunct in coating the valley flashings of shingle roofs. One gallon (approx. 9 lb) required per 100 sq ft of roof area. Furnished in 1, 5 and 55-gal containers.

**Asbestos Fibrous Roof and Foundation Coating:** An asphalt coating reinforced with asbestos fibers for roofs which have been badly neglected and deterioration is under way to the extent that deep checking is plainly visible. For such conditions the asbestos fibers serve to fill and reinforce the low eroded places. The right kind of fiber from the J-M mines is always available to assure uniform quality. One gallon (approx. 9 lb) covers about 100 sq ft depending upon condition of roof. Furnished in 1, 5 and 55-gal containers.

Asbestos Fibrous Roof and Foundation Coating is also widely used to provide a damp-proofing for the exterior foundations of homes, commercial and industrial buildings.

**Black Plastic Cement:** A high grade plastic roof cement made of asbestos fibers and asphalt for repair-



*A coat of Regal Roof Coating every two or three years will materially lengthen the life of a roof*

ing cracks and holes on old roofs, or new roofs damaged by accidental blows or roof cracks developing from the unexpected movement of the building itself. Besides roof repairs, Black Plastic Cement is ideal for repairing flashings or for filling breaks in parapets, penthouses and other roof structures. Furnished in pint, quart, and 1/2, 1, 5 and 55-gal containers.

**Roof Application:** The roof surface must be dry and free of all dirt and loose material. Nails or other projections should be removed or flattened. The coatings can be applied with a three-knot roofing brush or a squeegee. For small areas, an ordinary paint brush may be more convenient. A trowel is used for applying Black Plastic Cement.

**Foundation Application:** Before applying Asbestos Fibrous Roof and Foundation Coating, thoroughly brush the surface to remove all loose sand and cement. Apply with a three-knot roofing brush in a thick uniform coating. This product is designed for damp-proofing exterior foundations. . . . It will not function as a waterproofing agent.

**Note:** All of the materials mentioned are provided in sealed containers of the right consistencies for dependable service and should not be thinned or changed in any manner. At temperatures below 40 F, the materials should be kept in a warm room until time to use. While not easily ignited, they should not be placed over a flame to raise the temperature.

PRODUCT INFORMATION IS SUBJECT TO FREQUENT CHANGE. THE EXACT DETAILS AND AVAILABILITY AT PARTICULAR LOCATIONS SHOULD BE CHECKED WITH THE NEAREST JOHNS-MANVILLE OFFICE

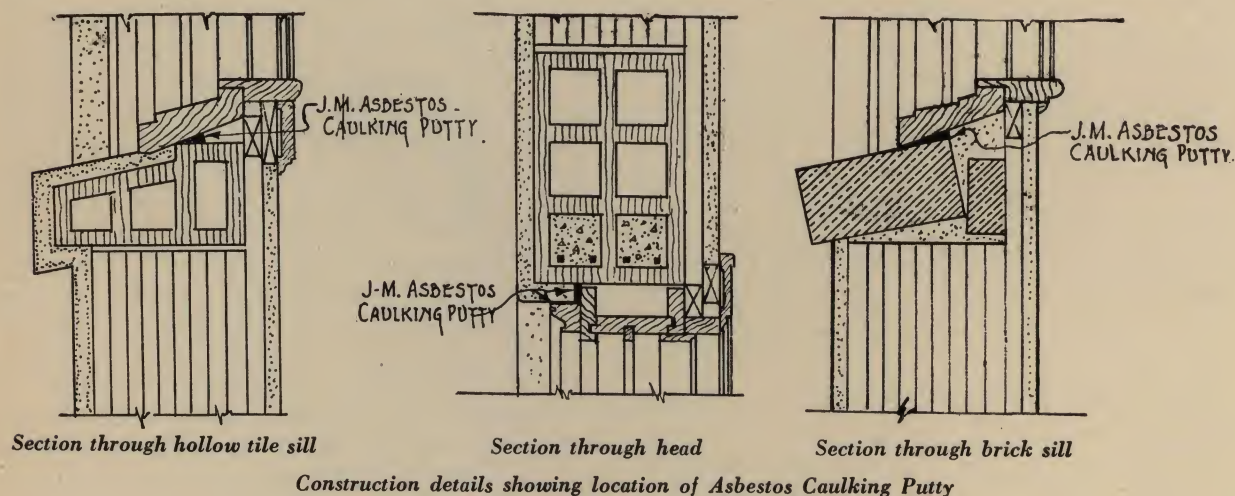


### Asbestos Caulking Putty

J-M Asbestos Caulking Putty is made of asbestos fibers, pigments and drying oils, blended to withstand alternate expansion and contraction and varying weather conditions. The putty will not dry or run in hot weather nor become brittle in cold weather, and will adhere to wood, metal, brick, stone or asbestos-cement products. It is recommended for use wherever it is desirable to caulk for protection against water, moisture, or infiltration of air—such as application at door and window casings, staff molds, corner boards, and mitered corners; for setting window and door

frames, skylights, scuttles, copings, etc.; pointing-up or repairing tin, slate, glass, concrete, cement or stone; glazing steel sash; caulking around sewer, gas and water pipes where they pass through walls; and for caulking sidewalk lights.

J-M Asbestos Caulking Putty is furnished as follows: "Gun Grade" in white, gray and tan for application with a caulking gun; and "Knife Grade" in gray only for application with a trowel or putty knife. The grade desired should be specified. The approximate shipping weight is 13 lb per gallon. Available in 1/10-gal cartridges, and quart, gallon and 5-gal containers.



## J-M Building Papers and Felts

J-M Building Papers and Felts are made from selected materials to give maximum service in building construction.

**Asbestos Slaters Felt:** A high-grade asbestos product for use as a sheathing felt and as a liner under shingles, tile or slate. This asphalt-saturated asbestos felt is furnished in 3-sq rolls, 32" wide, weighing approximately 45 lb per roll.

**Asphalt-Saturated Rag Felt:** This felt is used as a sheathing felt under shingles, slate or tile; also used for certain types of built-up roofs. Furnished in 36"-wide rolls as follows:

Style No.	Area of Roll, Sq Ft	Approx. Wt per roll, lb
15	432	60
30	216	60

Style No. 15 Felt is available perforated as well as unperforated; No. 30 unperforated only.

**Asphalt Slaters Felt, 30-lb:** This felt, for use as a liner under roofs and on walls, is supplied in 500-sq ft rolls, 36" wide, weighing approximately 30 lb per each 500-sq ft roll.

**Deadening Felt:** An unsaturated rag felt for use in walls and floors to keep out sounds and drafts. Also used under linoleum and as a base for wallpaper. It is furnished as follows:

Width	Wt per sq yd	Sq Ft per Roll	Approx. Wt per Roll
36"	$\frac{3}{4}$ lb	450	38 lb
36"	1 lb	450	50 lb

**Red Rosin-Sized Sheathing Paper:** An inexpensive sheathing paper in rolls 36" wide for sheathing houses, protecting new wood-work, etc. The paper is supplied in 500-sq ft rolls, in three approximate weights—20, 25 and 30 lb per roll.











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# Roofing and Shingles

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No. 300—20-yr. roof, Wood . . . . .	BMR-170
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No. 401—10-yr. roof, Non-Combustible . . . . .	BMR-203

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No. 700—20-yr. roof, Wood . . . . .	BMR-470
No. 702—20-yr. roof, Non-Combustible . . . . .	BMR-472
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#### ★Catalog pages

#### Specifications, Special Built-up Roofs over Insulation:

No. 325—20-yr. roof (coal tar pitch) . . . . .	BMR-180
No. 326—15-yr. roof (coal tar pitch) . . . . .	BMR-182

#### Specifications, Insulation under Tar and Gravel Roofs:

No. 1000—J-M Roof Insulation over Wood . . . . .	BMR-480
No. 1001—J-M Roof Insulation over Non-Comb. . . . .	BMR-481
No. 1002—J-M Roof Insulation over Steel . . . . .	BMR-482

#### Specifications, Flexstone Special Built-up Roofs

No. 300—20-yr. roof, Wood . . . . .	BMR-170
No. 301—20-yr. roof, Non-Combustible . . . . .	BMR-172

#### Specifications, Rag Felt, Tar and Gravel Roofs over Insulation:

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★Asbestos . . . . .	BMR-925 to 934
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Care and maintenance, siding . . . . .	BMR-1000
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Metal Flashing Systems . . . . .	BMR-960 to 962
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Method of estimating, roofing . . . . .	BMR-956 to 958
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Method of estimating, siding . . . . .	BMR-981
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Roofing application directions . . . . .	BMR-965 to 974
--	----------------

Siding application directions . . . . .	BMR-989 and 990
---	-----------------

★Asphalt . . . . .	BMR-940 to 950
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Method of estimating, roofing . . . . .	BMR-956 to 958
---	----------------

Method of estimating, siding . . . . .	BMR-981
--	---------

Roofing application directions . . . . .	BMR-1040 to 1080
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Siding application directions . . . . .	BMR-1095 and 1110
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## J-M Bonded Built-up Roofs



*Johns-Manville provides a built-up roof for every requirement*

Built-up roofs provide the most scientific and economical method of roofing all types of large buildings with low-pitched roofs. Whether the problem is merely one of simple protection from the elements or one involving resistance to the passage of heat or cold, the seamless built-up construction is the most practical for the low-pitched type of roof covering large areas.

The modern J-M Built-up Roof consists of several layers of waterproofed felts cemented together with a bituminous material, securely fastened to the roof deck and thoroughly protected at all junctions formed by the deck and vertical surfaces with the Johns-Manville System of Flashing.

Johns-Manville has developed, over a long period of years, a large number of different types of built-up roofs, each of which is designed to meet certain definite requirements in type of construction and incline of roof, the expected life of the building and other economic factors involved.

### Types of J-M Built-up Roofs

The number and kind of felts used, either asbestos or rag, vary with the different types of roofs. The final surfacing also varies, being either a smooth-surfaced coating, slag or gravel, or felt with a colored mineral surface. This makes possible a wide selection according to desired effect, conditions in structure, protective requirements and service. The smooth-surfaced asbestos roof, however, gives the best roof assurance.

**Asbestos Smooth-Surfaced Roofs:** J-M Smooth-

Surfaced Asbestos Built-up Roofs are the outgrowth of many years of study and experience in producing durable, fireproof, weather-proof, light-weight, roofs at a moderate cost. They are suited for practically every type of industrial building, warehouse, office building, hotel, hospital and apartment house. This type of roof consists of built-up, alternating layers of asphalt-saturated asbestos felt and roofing asphalt. The top finish is a specially prepared cold asphaltic roof-coating.

In addition, J-M provides the special Flexstone built-up roof with tar-saturated asbestos felts and pitch.

The numerous advantages of smooth-surfaced asbestos roofs include resistance to fire and heat of the sun, protection against decay, easy location of leaks, quick and inexpensive repairs, and no excessive weight (owing to the elimination of slag or gravel often employed as a surfacing).

**Combination Smooth-Surfaced Roofs:** Johns-Manville specifies several types of combination rag felt and asbestos felt built-up roofs. These roofs employ an asphalt-saturated rag base felt and asphalt-saturated asbestos finishing felts. The top surface is a cold asphaltic roof-coating.

**Gravel or Slag-Surfaced Roofs:** These J-M Roofs consist of several layers of tar-saturated rag felts employing gravel or slag for the top surfacing. Similar in construction are roofs designed for spray pond service (double surfacing of slag or gravel) and built-up roofs which will be overlaid with promenade surfacings embedded in cement.





*J-M Built-up Roofs are designed to meet definite requirements in type of construction and incline of roof*

**Mineral-Surfaced Roofs:** Where an ornamental mineral-surfaced roof is desired, J-M Split Sheet Slatekote Roofing may be used over asphalt-saturated rag felts.

**Insulated Roofs:** J-M insulated roofs employ J-M Roofinsul, Rock Cork Roof Insulation, or other approved insulation, under the various types of built-up roof construction. The J-M system of insulating roofs is especially designed to prevent condensation on the under side of the deck and to eliminate discoloration of ceilings and the annoyance and damage caused by roof drip. The numerous advantages of roof insulation and the various problems involved appear on other data sheets.

### Flashings

One of the most important steps in built-up roof construction is the flashing. More than any other place on a roof, leaks occur at the junction formed by the roof deck and a vertical surface, such as a parapet wall, skylight curb or wall of an adjacent building.

Johns-Manville has designed several types of flashings to accommodate the different structural conditions encountered in a roof. The flashing felts, made from the same basic materials as the asbestos roofing felts, are used in conjunction with a waterproofing or cementing agent specially prepared by Johns-Manville. Drawings illustrating typical flashing methods are shown on other data sheets.

### Application and Inspection

Proper application of the materials is just as important in constructing a built-up roof as are the materials themselves. For this reason, in every community J-M Approved Roofers have been appointed. These appointments are based on thoroughness of workmanship and on financial responsibility.

Inspection by a Johns-Manville representative is required on every roof which is to be bonded, and is rendered before, during, and after the application of the roof.

Detailed application directions for Johns-Manville Bonded Built-up Roofs, using either asphalt-saturated felts with bonded asphalt or tar-saturated felts with standard pitch, are set forth on separate data sheets.

**Painting:** Where painting is desired, as on airport roofs, it is vital that the paint or primer be especially adapted for application over asphaltic surfaces. Otherwise, bleeding will occur.

### Bonded Roofs

All Johns-Manville Built-up Roofs, except on the Pacific Coast, will, when desired, be covered by a bond of the National Surety Corporation, guaranteeing the performance of the particular roof for a period of from ten to twenty years, depending upon the type of roof applied. This bond is issued only on roofs laid by Johns-Manville Approved Roofing Contractors and in conjunction with the J-M Inspection Service.

### Flashing Endorsement

Where J-M Flashing Materials are used in conjunction with Johns-Manville Built-up Roofs, a ten to twenty-year flashing endorsement will be attached to and become part of the bond, under the same conditions as are imposed for the roof.



*The smooth-surfaced asbestos roof gives the best roof assurance*



## Built-up Roofing Felts and Cap Sheets



*Flexstone Smooth-Surfaced Built-up Roofs combine the best in roofing materials, engineering practice and application methods*

The weights given for the following J-M Built-up Roofing Felts and Cap Sheets are approximate.

**Asbestos Base Flashing (Reinforced):** This material, consisting of an outer layer of asphalt-saturated asbestos felt and a layer of asphalt-saturated fabric, cemented together at the factory, is used in conjunction with J-M System of Flashing and for edging. Furnished in rolls of 108 sq ft, 32" wide, weighing 65 lb; 54 sq ft, 16" wide, weighing 33 lb. For edging, there are rolls 8" wide by 40 ft 6" long, weighing 16 lb.

**15-lb Asbestos Finishing Felt (Perforated):** An asphalt-impregnated asbestos felt which is perforated to allow entrapped air to escape from underneath the felt at the time of application. The perforations also cause better embedment in the bitumen. The felt is used for asbestos and combination rag and asbestos built-up roofs. Also used for felt-stripping base flashing, for constructing three and five-course Asbestile wall treatment. Mopping lines facilitate laying of the felt which is furnished in 3-sq rolls (324 sq ft) 32" wide. This material weighs 45 lb per roll. Also cut in 4"-wide strips for felt-stripping, in rolls of 121½ linear feet weighing 5½ lb per roll.

**15-lb Asbestos Finishing Felt (Unperforated):** An asphalt-saturated unperforated asbestos felt used as a vapor barrier under approved roof insulation. Fur-

nished in 3-sq rolls (324 sq ft) 32" wide, weighing 45 lb per roll.

**Flexstone Smooth-Surfaced Roofing, Extra Heavy:** Composed of four layers of asbestos felt, thoroughly saturated and cemented together with asphalt. Used as a cap sheet over certain types of bonded built-up roofs where there is light foot traffic. Furnished in sheets 32" x 80". Six sheets (74 lb) per square.

**No. 45 Rag Base Felt:** Heavy rag felt, thoroughly saturated and coated with asphalt. Used as a base felt on certain rag and asbestos felt bonded built-up roofs. Furnished in 1-sq rolls (108 sq ft), 36" wide, weighing 53 lb per roll.

**Salamander White Top Asbestos Roofing:** A 2-ply material composed of an unsaturated and a saturated asbestos felt cemented together, used with the white surface exposed as a cap sheet on sawtooth and other pitched surfaces for light reflection. Furnished in 2-sq rolls (216 sq ft), 32" wide, with 1½" selvage edge, weighing 68 lb per roll.

**Split Sheet Slatekote Roofing:** Heavy asphalt-saturated rag felt, 36" wide, with 19" selvage edge for cementing and with 17" of exposed section mineral-surfaced. Used as a cap sheet on built-up roofs where color is desired. It is furnished in rolls weighing 55 lb. Each roll covers 50 sq ft weather area.



**Asphalt-Saturated Rag Felt:** A felt used for certain asphalt and rag felt built-up roofs and as a liner under shingles. The asphalt-saturated rag felt is furnished in

Style Number	Area of roll, sq ft	Total weight per roll, lb
30	216	60
15	432	60

rolls 36" wide as indicated in the table shown above. Style No. 15 is also available perforated.

**No. 50 Asbestos Base Felt:** A perforated asbestos felt thoroughly saturated with asphalt. This felt is used as a base sheet on certain asbestos felt bonded built-up roofs. Furnished in 2-sq rolls (216 sq ft), 32" wide, weighing 64 lb.

**Tar-Saturated Rag Felt:** Used in service with Standard Roofing Pitch and slag or gravel on built-up

roofs. Furnished in style No. 15 in 4-sq rolls (432 sq ft), 36" wide. The weight is 60 lb per roll.

**Special No. 50 Tar-Saturated Asbestos Felt:** A perforated tarred asbestos felt for use with the Flexstone special built-up roofs. Furnished in 2-sq rolls (216 sq ft), 32" wide, weighing 64 lb per roll.

**Special 15-lb Tar-Saturated Asbestos Finishing Felt:** A perforated, tarred asbestos felt used for the Flexstone special built-up roofs. Furnished in 3-sq rolls (324 sq ft), 32" wide, weighing 45 lb per roll.

**Cold Application Asbestos Felt:** A double-coated cap sheet for use in the cold-application of asbestos felts. The asbestos felt is furnished in 2-sq rolls (216 sq ft), 32" wide, weighing 70 lb per roll.

**Regal Cap Sheet:** A rag felt cap sheet which is furnished in 1-sq rolls (108 sq ft), 36" wide.



*This J-M Smooth-Surfaced Built-up Roof was installed on the plant of a large water power and paper company*



## Asphalts, Coatings and Accessories

**Asbestos Fibrous Roof and Foundation Coating:** A high-grade black roof coating made of asbestos and asphalt in the right consistency for brush application. It is for use where the roof is in bad condition, such as rusted metal roofs, and where "checking" is apparent on asphalt roofings. The asbestos fibers fill and reinforce the low, eroded spots and restore the original resistance. Covering capacity, about 100 sq ft per gal, depending on condition of roof. Shipped in 1, 5 and 55-gal containers.

**Black Plastic Cement:** A high-grade plastic roof putty, made of asbestos fiber and asphalt, which clings tenaciously to metal, felt, wood or glass. Used for patching leaky roofs, setting flashing flanges around vent pipes and for various other purposes. Furnished in various sized containers from 1 pint to 55-gal.

**Bonded (Filled) Roofing Asphalt:** This asphalt is used on J-M Bonded Built-up Roofs, except those in which tar-saturated asbestos or rag felts are used.

The asphalt is furnished in solid form in various sized containers.

**Cold-Application Cement:** A cement used with cold-application of asbestos felts for built-up roofs. It is furnished in 5 and 55-gal containers.

**Concrete Primer:** A thin liquid asphalt especially prepared for priming concrete or gypsum decks to



*J-M Smooth-Surfaced Asbestos Built-up Roofs are suited for practically all types of industrial and commercial buildings*

form a bond between the asphalt and the deck. It is always applied cold and must be allowed to dry thoroughly. If material thickens it may be thinned with gasoline, naphtha or benzine. Kerosene must not be used for this purpose. Covering capacity about 1 to 2 gal per 100 sq ft, depending upon the surface. Furnished in containers of 5 and 55-gal.

**Insulating Board Cant Strips:** Strips supplied 8-ft long with a 4" face, weighing approximately 4 lb per 8-ft section. Supplied 16 pieces per package.

**Ready-Mixed Asbestile:** A heavy-bodied plastic cement composed of asbestos fiber, asphalt and other mineral ingredients, designed to afford thorough watertightness over asbestos base flashing where used in conjunction with the 4" strips of asphalt-saturated asbestos felt. It is particularly adapted for use in the J-M System of Three-Course Asbestile on the flashing of parapet walls, and in the felt-stripping of base flashing material. Furnished in 5, 15, 30 and 55-gallon containers.

**Regal Roof Coating:** A high-grade black asphaltic roof coating, applied cold as the surface finish on

PRODUCT INFORMATION IS SUBJECT TO FREQUENT CHANGE. THE EXACT DETAILS AND AVAILABILITY AT PARTICULAR LOCATIONS SHOULD BE CHECKED WITH THE NEAREST JOHNS-MANVILLE OFFICE



*This roofing "sandwich" consists of pieces of J-M Asbestos Felt (right) and rag felt (left) stapled between highly inflammable material. When lighted, the sandwich instantly bursts into flame. When it goes out, the organic rag felt is burned to ashes; the mineral J-M Asbestos Felt looks slightly sooty but is unharmed*



smooth-surfaced J-M Bonded Built-up Roofs. One gallon (approx. 8 lb) required per 100 sq ft of roof area. Furnished in containers of 5 and 55-gal.

**Roofinsul:** A strong, rigid sheet of high insulating value made of southern pine fiber, interlaced, felted and rolled into board form. It is used over roof decks in conjunction with built-up roofs. Roofinsul is supplied in four types: "Standard," no impregnant or coating; "Coated Weathertite," impregnated with an asphalt admixture and coated with asphalt; "Coated," with asphalt only; and "Weathertite," impregnated with an asphalt admixture only. All types supplied 23 $\frac{3}{4}$ " x 48", in thicknesses of  $\frac{1}{2}$ ", 1", 1 $\frac{1}{2}$ " and 2". Approximate weights per sq ft,  $\frac{1}{2}$ " thick, range from 0.65 lb for Standard to 0.85 lb for Coated Weathertite.

**Rock Cork Roof Insulation:** Made of mineral wool combined with a waterproof binder, this excellent insulation material will maintain its efficiency indefinitely. Asphalt-saturated rag felt applied to one side of the Rock Cork with a high melting point asphalt permits felt-to-felt bonding with the built-up roof. Rock Cork is non-capillary and does not rot, support mold or disintegrate. The insulation is furnished in sheets 18" x 36" in thicknesses of 1 $\frac{1}{2}$ " and 2". The weight of Rock Cork Roof Insulation is about 2.9 lb per sq ft, 2" thick.

**Roofing Nails and Caps:** One inch bright roofing nails are used with caps on built-up roofing over wood decks. For nailing flashing, 1" large head, thick-shank nails are used.

**Roofing Tape:** A waterproofing fabric for use with roof coatings and putties for mending or bridging large cracks or holes in old asphalt roofings. Furnished in rolls of 36 linear ft, 3" wide.

**Rosin-Sized Sheathing Paper:** An inexpensive red sheathing paper used with certain types of J-M Built-up



*These large docks are roofed with J-M smooth-surfaced asbestos built-up roofing*

Roofs. Supplied in rolls 36" wide, in three weights: about 20, 25 and 30 lb per roll of 500 sq ft.

**Special A. R. Roof Putty:** A black roof putty, more adhesive than Black Plastic Cement. Especially suitable for quick repairs on smooth surface asphalt roofs where it is necessary to seal plies of felt together. The putty is packed in containers holding 1, 5 and 15 gallons.

**Standard Asphalt Waterproofing Cement:** A specially compounded asphalt used particularly on spray decks and for other waterproofing work relating to built-up roofs. Furnished in suitable containers.

**Standard Roofing Asphalt:** Used for certain types of built-up roofs. Furnished in four types, 140, 150, 170 and 190 (the numbers indicating approximate melting points). Shipped in solid form in various sized containers.

**Standard Roofing Pitch:** Used on bonded roofs for certain specifications. The pitch is shipped in solid form in various sized containers.



## Johns-Manville Built-up Roofs

The brief outline descriptions, on this and following pages, cover Smooth-Surfaced Asbestos Roofs, Roofs of materials" and one representative drawing is shown over Approved Insulation, Tar and Gravel Roofs, Roof for each classification.

### Flexstone Built-up Roofs—Asphalt-Saturated Asbestos Felts

#### Bill of Materials per 100 Sq Ft

Application Over	J-M Designation	Primer, lb	Felts			Asphalt, lb	Coating, lb	Bond, Years
			Base	lb	Finishing			
Wood, Inclines, ½" to 6" per ft	Super A (Spec. 100)	—	No. 50 Asb.	32	3, 15-lb Asb.	45	90	20
	Super A (Spec. 205)	—	No. 45 Rag	53	3, 15-lb Asb.	45	90	20
	Standard (Spec. 103)	—	No. 50 Asb.	32	2, 15-lb Asb.	30	60	15
	Standard (Spec. 200)	—	No. 45 Rag	53	2, 15-lb Asb.	30	60	15
	Service (Spec. 202)	—	No. 30 Rag	30	2, 15-lb Asb.	30	60	10
Non-Combustible,* Inclines, ½" to 6" per ft	Super A (Spec. 101)	**	No. 50 Asb.	32	2, 15-lb Asb.	30	90	20
	Standard (Spec. 201)	**	No. 45 Rag	53	2, 15-lb Asb.	30	90	15
	Service (Spec. 203)	**	No. 30 Rag	30	2, 15-lb Asb.	30	90	10
Approved Insulation, Inclines ½" to 6" per ft	Super A (Spec. 125)	—	—	—	4, 15-lb Asb.	60	130	20
	Standard (Spec. 126)	—	—	—	3, 15-lb Asb.	45	100	15
	Service (Spec. 127)	—	—	—	1, No. 15 Rag 2, 15-lb Asb.	15 30	100	8 10

\* Including nailable types but excluding steel. \*\* On concrete, 1 gal or 8 lb; gypsum, 1½ to 2 gal or 12 to 16 lb.

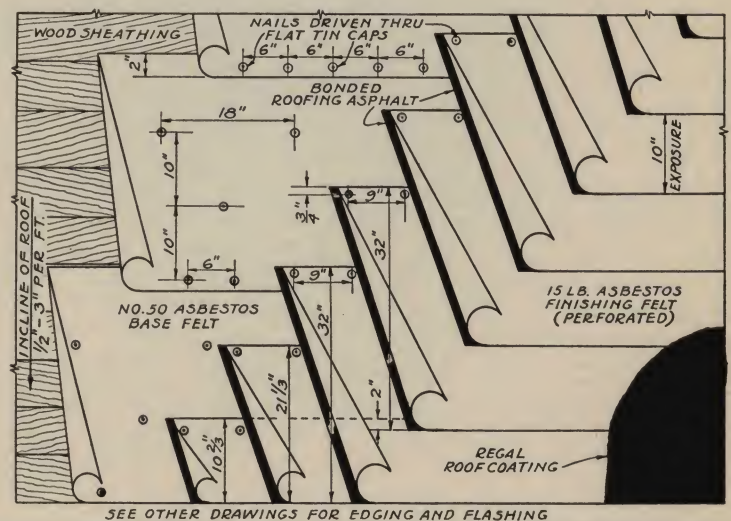
### Flexstone Special Built-up Roofs—Tar-Saturated Asbestos Felts

#### Bill of Materials per 100 Sq Ft

Application Over	Incline of Deck	J-M Designation	Sheathing Paper, lb	Special Felts				Pitch, lb	Bond, Years
				Base	lb	Finishing	lb		
Wood	Dead Level to ½" per ft	Spec. 300	5	No. 50	32	3, 15-lb	45	110	20
Non-Combustible*	Dead Level to ½" per ft	Spec. 301	—	No. 50	32	2, 15-lb	30	110	20
Approved Insulation	Dead Level to ½" per ft	Spec. 325	—	—	—	4, 15-lb	60	150	20
		Spec. 326	—	—	—	3, 15-lb	45	120	15

\* Including nailable types but excluding steel.

Illustrating the Flexstone Super A Built-up Roof (Spec. 100) over a wood deck: One layer of No. 50 Asbestos Base Felt laid dry; three layers of 15-lb Asbestos Finishing Felt (Perforated) mopped with Bonded Roofing Asphalt; and a top coating of Regal Roof Coating

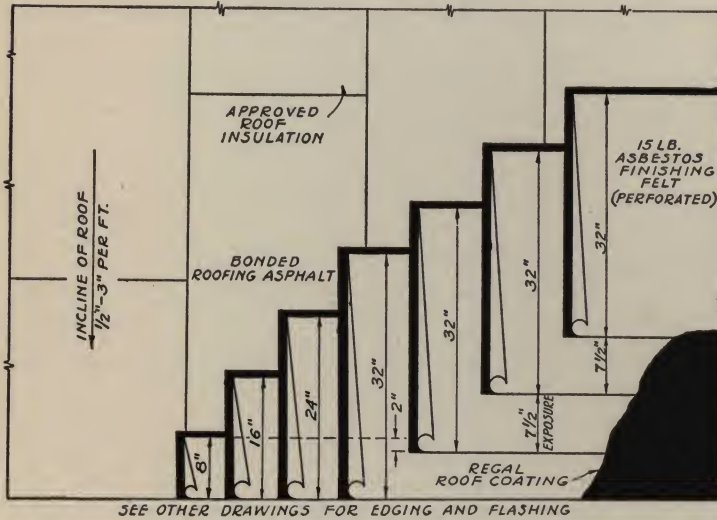
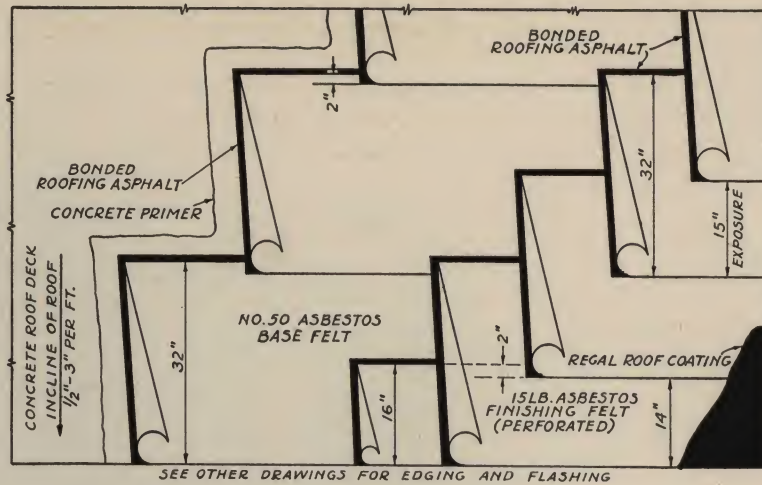


SEE OTHER DRAWINGS FOR EDGING AND FLASHING



Right:

**Flexstone Super A Built-up Roof (Spec. 101)** over a non-combustible deck: One layer of No. 50 Asbestos Base Felt laid with Concrete Primer and Bonded Roofing Asphalt; two layers of 15-lb Asbestos Finishing Felt (Perforated) mopped with Bonded Roofing Asphalt; and a top coating of Regal Roof Coating

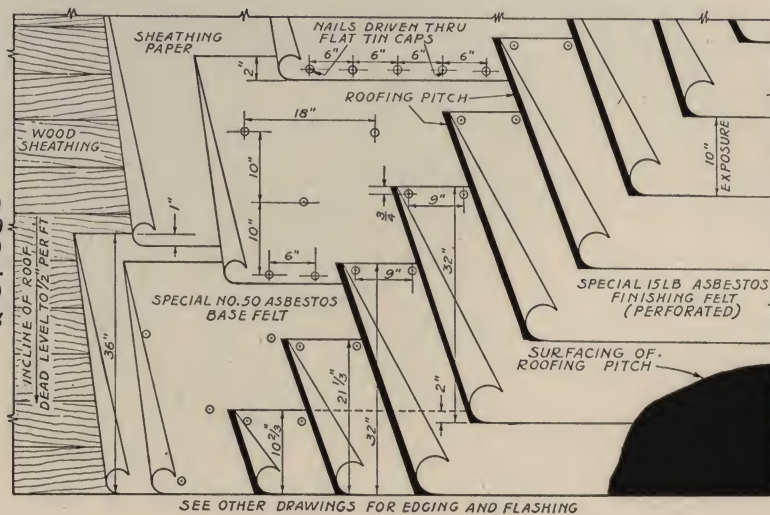


Left:

**Flexstone Super A Built-up Roof (Spec. 125)** over Approved Roof Insulation: Four layers of 15-lb Asbestos Finishing Felt (Perforated) mopped with Bonded Roofing Asphalt; and a top coating of Regal Roof Coating

Right:

**Flexstone Special Built-up Roof (Spec. 300)** over a wood deck: One layer of Special No. 50 Tar-Saturated Asbestos Base Felt (Perforated) laid dry; three layers of Special 15-lb Tar-Saturated Asbestos Finishing Felt (Perforated) mopped with Roofing Pitch and a top coating of Roofing Pitch



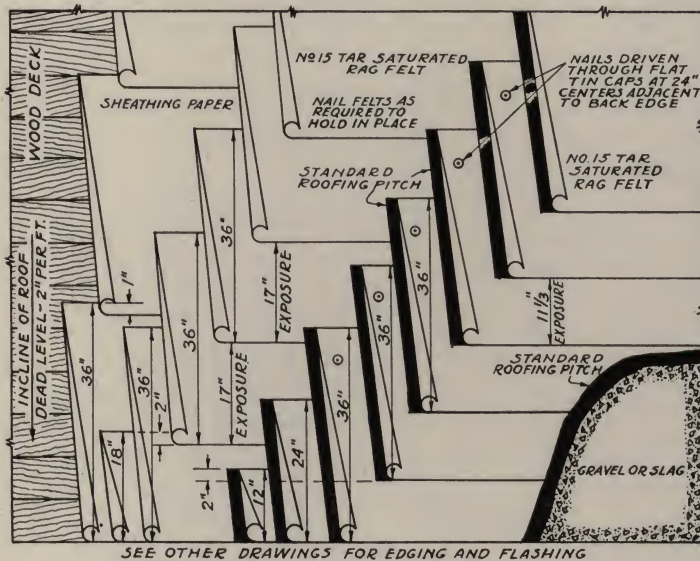


## Tar and Gravel Built-up Roofs—Tar-Saturated Rag Felts

## Bill of Materials per 100 Sq Ft

Application Over	J-M Designation	Paper, lb	Felts		Pitch, lb	Surfacing, lb Gravel or Slag		Bond, Years
			Type	lb				
Wood or Other Nailable Type such as Gypsum, Inclines Dead Level to 2" per Ft	5-Ply (Spec. 700)	5	5, No. 15 Rag	75	165	400	300	20
	4-Ply (Spec. 704)	5	4, No. 15 Rag	60	135	400	300	15
Non-Combustible* or Over Approved Insulation, Inclines Dead Level to 2" per Ft	4-Ply (Spec. 702)	—	4, No. 15 Rag	60	200	400	300	20
	3-Ply (Spec. 705)	—	3, No. 15 Rag	45	175	400	300	15

\* Non-Combustible but excluding Nailable Type and Steel Decks.

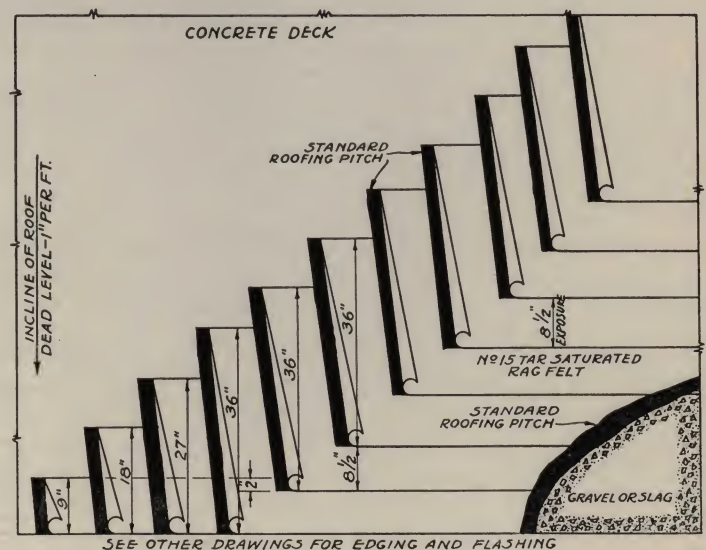


Left:

The 5-Ply Tar and Gravel Built-up Roof (Spec. 700) over a wood deck: One layer of sheathing paper laid dry; two layers of 15-lb Tar-Saturated Rag Felt laid dry and three layers mopped with Standard Roofing Pitch. Surfaced with gravel or slag embedded in Standard Roofing Pitch.

Right:

The 4-Ply Tar and Gravel Built-up Roof (Spec. 702) over a concrete deck: Four layers of 15-lb Tar-Saturated Rag Felt mopped with Standard Roofing Pitch, and surfaced with gravel or slag embedded in Standard Roofing Pitch.



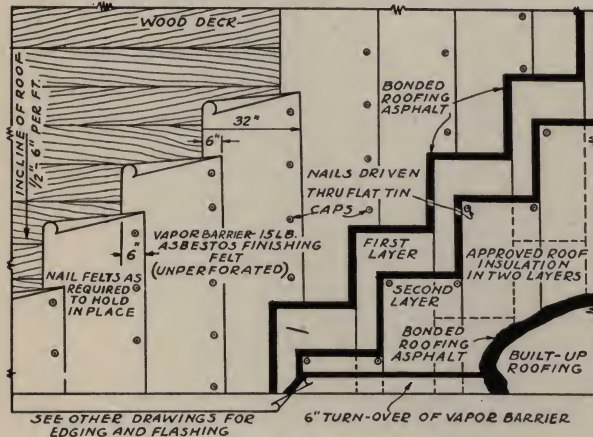


# Application of Approved Roof Insulation under Asphalt Built-up Roofs

## Bill of Materials per 100 Sq Ft

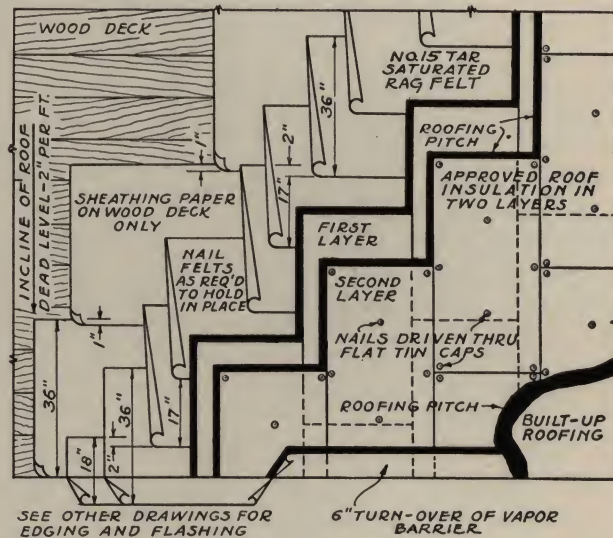
Application Over	Incline, in. per ft	Primer, lb	Felts		Asphalt, lb		Built-up Roofing
			Type	lb	Felt	Insulation	
Wood (Spec. 500)	1/2 to 6	—	1, 15-lb Asb.	15	—	40 per layer	{ Per Spec. 125, 126, or 127
Non-Comb.* (Spec. 501)	1/2 to 6	(Note)	1, 15-lb Asb.	15	30	40 per layer	
Steel (Spec. 502)	1/2 to 6	(Note)	1, 15-lb Asb.	15	30	40 per layer	

\* Non-Combustible (Including Nailable Types but excluding Steel). (Note): On Concrete and Steel not shop prime-coated, 1 gal or 8 lb; Gypsum, 1 1/2 to 2 gal or 12 to 16 lb.



Left:

Application of Approved Roof Insulation (Spec. 500) over Wood Decks: One layer of 15-lb Asbestos Finishing Felt (Unperforated) laid dry and two layers of Approved Roof Insulation mopped with Bonded Roofing Asphalt. To be overlaid with J-M Built-up Roofing Employing Asphalt



Right:

Application of Approved Roof Insulation (Spec. 1000) over Wood Decks: One layer of Sheathing Paper, two layers of No. 15 Tar-Saturated Rag Felt laid dry, and two layers of Approved Roof Insulation mopped with Standard Roofing Pitch. To be overlaid with J-M Built-up Roofing Employing Coal Tar Pitch

# Application of Approved Roof Insulation under Coal Tar Pitch Built-up Roofs

## Bill of Materials per 100 Sq Ft

Application Over (Inclines to 2" per ft)	Felts		Pitch, lb		Asphalt, lb		Built-up Roofing
	Type	lb	Felt	Insulation	Felt	Insulation	
Wood* (Spec. 1000)	2, Tar	30	—	40 per layer	—	—	{ Per Spec. 325, 326, 702 or 705
N-C** (Spec. 1001)	1, Tar	15	30	40 per layer	—	—	
Steel (Spec. 1002)	1, Asphalt	15	—	—	30	40 per layer	

\* Or other Nailable Decks such as Gypsum. \*\* Non-Combustible (Except Nailable and Steel Decks).

Note: 5-lb Sheathing Paper on Wood Decks; 8-lb Concrete primer for steel not shop prime-coated.



## Mineral-Surfaced (Split-Sheet Slatekote) Built-up Roofs

## Bill of Materials per 100 Sq Ft

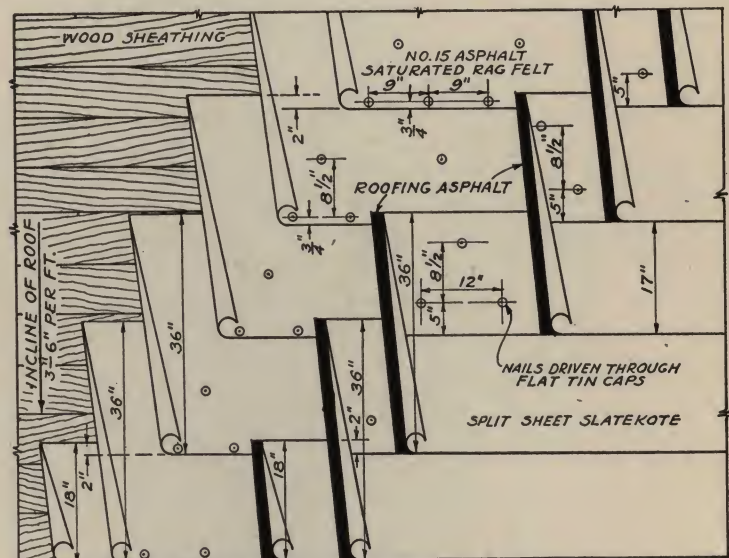
Application Over	Incline, in. per ft	Primer, lb	Base Felts		Finishing Felts		Asphalt, lb	Bond, Years
			Type	lb	Type	lb		
Wood (Spec. 400)	3 to 6	—	2, No. 15 Rag	30	2, Slatekote	110	60	10
Non-Comb.* (Spec. 401)	3 to 6	(Note)	1, No. 15 Rag	15	2, Slatekote	110	90	10

\* Non-Combustible (including Nailable Types but excluding Steel) Decks.

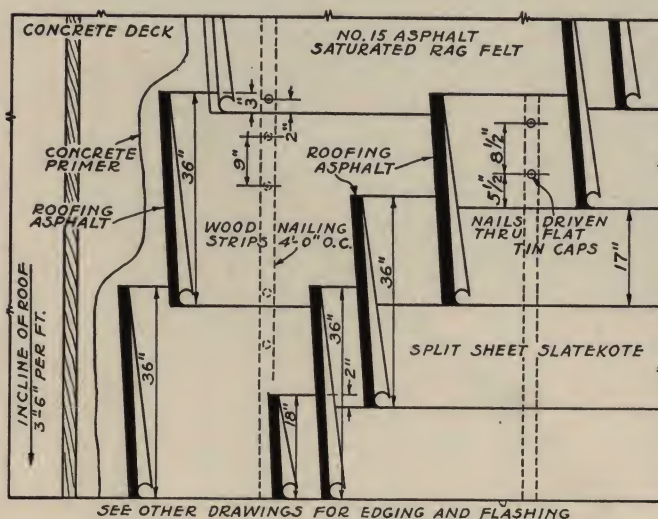
(Note): Concrete Primer over Concrete, 1 gal or 8-lb; over Gypsum  $1\frac{1}{2}$  to 2 gal, 12 to 16 lb.

Right:

The Split Sheet Slatekote-Surfaced Built-up Roof (Spec. 400) over a wood deck (incline  $3\frac{1}{2}$ " to 6" per ft): Two layers of No. 15 Asphalt-Saturated Rag Felt overlaid by two layers of the Slatekote



SEE OTHER DRAWINGS FOR EDGING AND FLASHING



SEE OTHER DRAWINGS FOR EDGING AND FLASHING

Left:

The Split Sheet Slatekote-Surfaced Built-up Roof (Spec. 401) over a concrete deck (incline  $3\frac{1}{2}$ " to 6" per ft): One layer of No. 15 Asphalt-Saturated Rag Felt overlaid by two layers of the Slatekote

## SUMMARY OF J-M BUILT-UP ROOFS

December, 1952 (Cancelling sheet dated January, 1949)

BMR-14



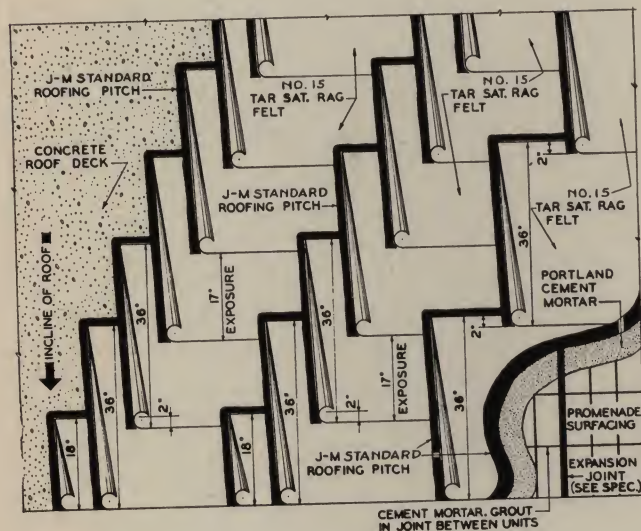
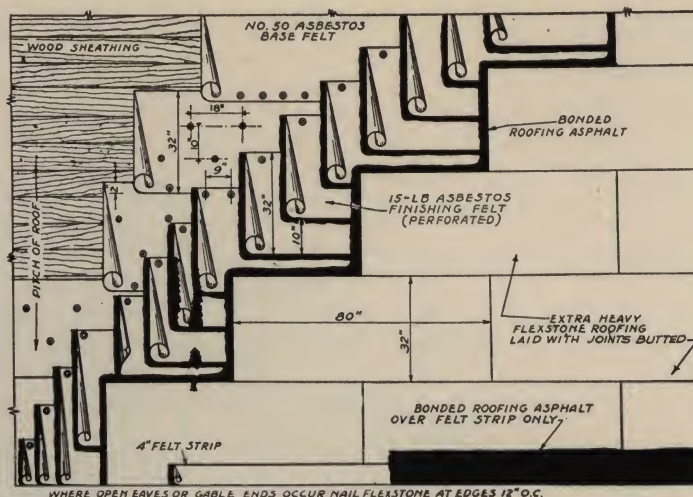
Specification No. 102 . . . . .

**J-M 20-Year Roof  
over Wood Decks  
for Light Foot Traffic only**

Surface: Smooth.  
Felts: Asphalt-Saturated Asbestos  
and Flexstone.  
Inclines:  $\frac{1}{2}$ " to 1" per foot.

**BILL OF MATERIALS—100 SQ FT**

Base Felt: One 32-lb and three 15-lb  
Asbestos Felts ..... 77 lb  
Finishing Felts: One layer of Flexstone..... 85 lb  
Roofing Asphalt: Bonded Filled .....120 lb  
Roof Coating: (Flexstone only)



Specification No. 712  
**J-M Built-up Roof  
over  
Non-Combustible Decks  
For Use Under Promenade Surfacing**

Surface: Smooth and under Prom-  
enade Surfacing.  
Felts: Spec. No. 712, Tar-Saturated  
Rag.  
Inclines: 1" per foot maximum.

**BILL OF MATERIALS—100 SQ FT**

Felts: Five 15-lb Felts ..... 75 lb  
Pitch: Roofing Pitch .....200 lb  
Surfacing: Promenade Tile.

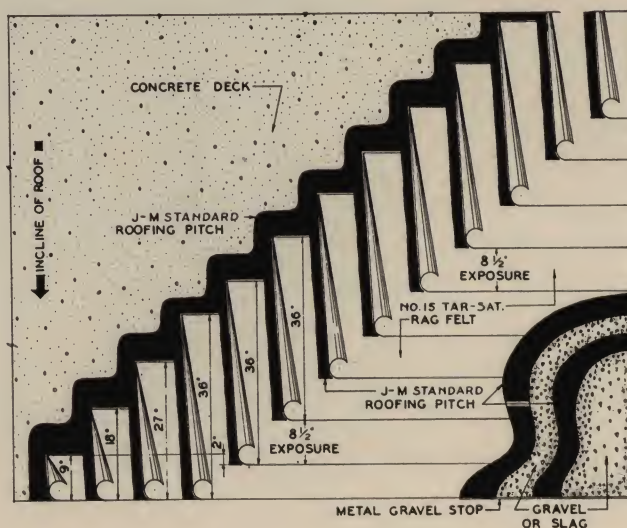
Specification No. 713 . . . . .

**Spray Pond Roofing  
(Double Surfacing)  
over  
Concrete Decks**

Surface: Gravel or Slag.  
Felts: Spec. No. 713, Tar-Saturated  
Rag.  
Inclines: Not exceeding  $\frac{1}{2}$ " per ft.

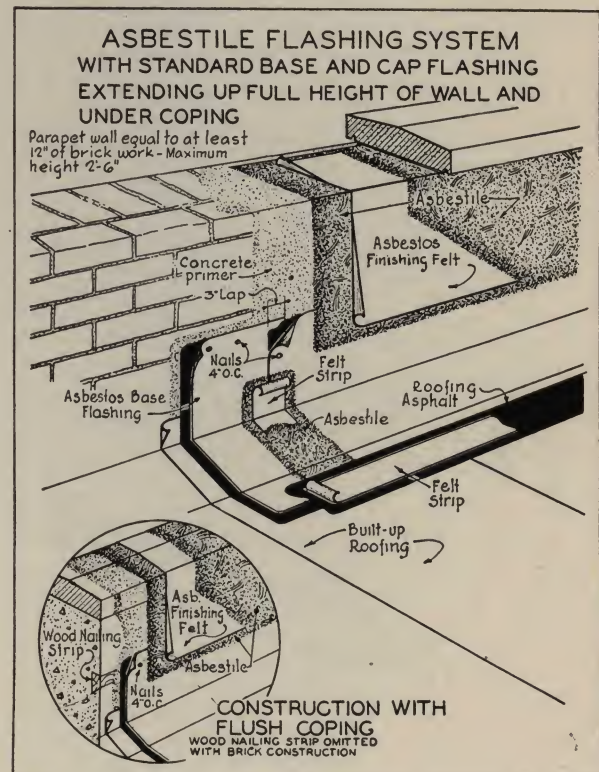
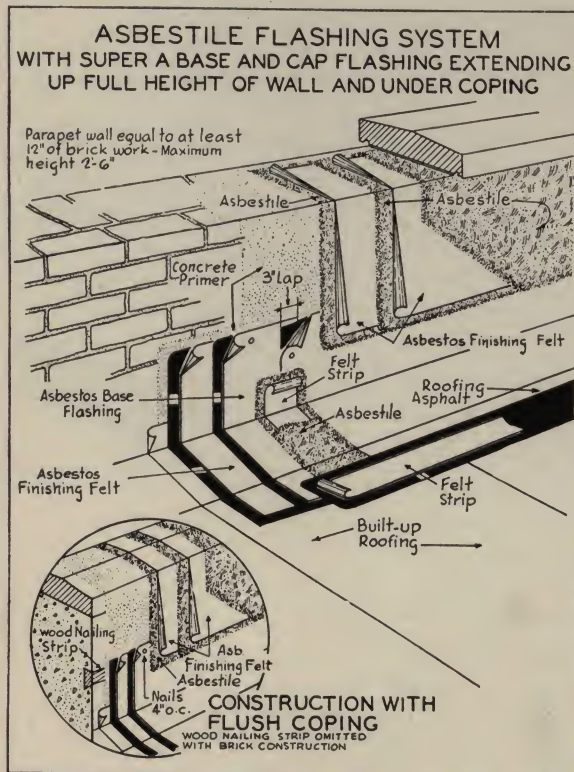
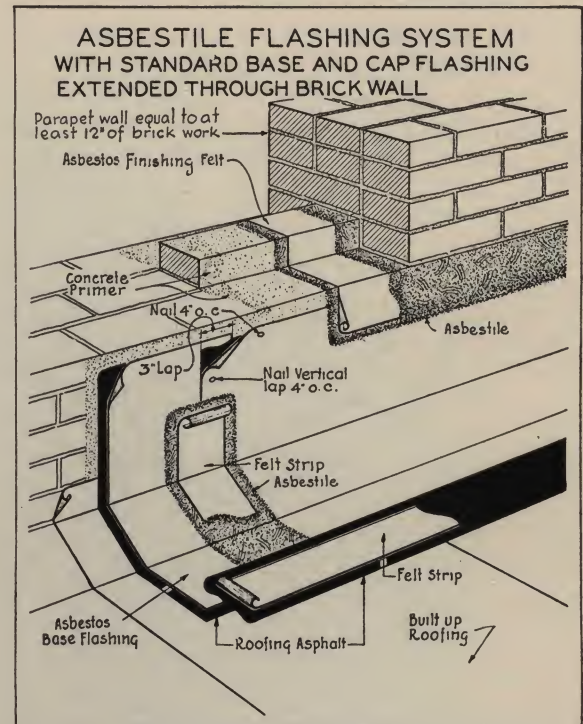
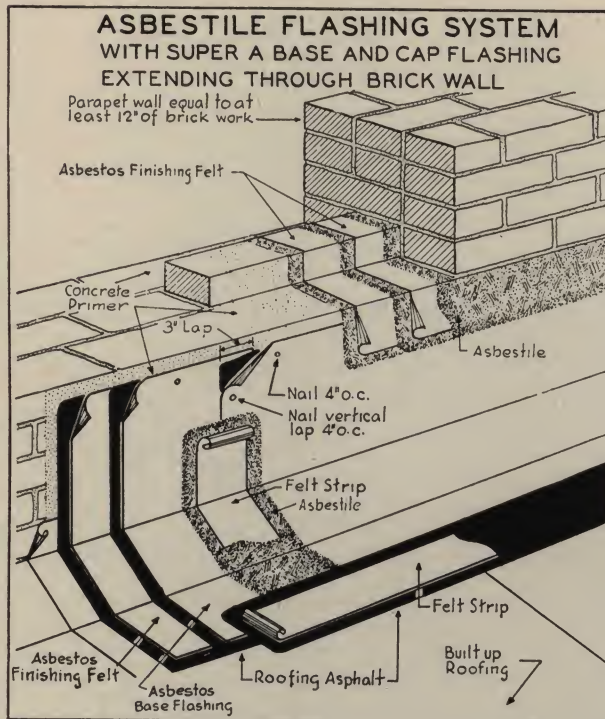
**BILL OF MATERIALS—100 SQ FT**

Felts: Four 15-lb Felts ..... 60 lb  
Pitch: Roofing Pitch .....300 lb  
Surfacing: Gravel.....400 lb first application  
300 lb second  
or Slag .....300 lb first application  
200 lb second

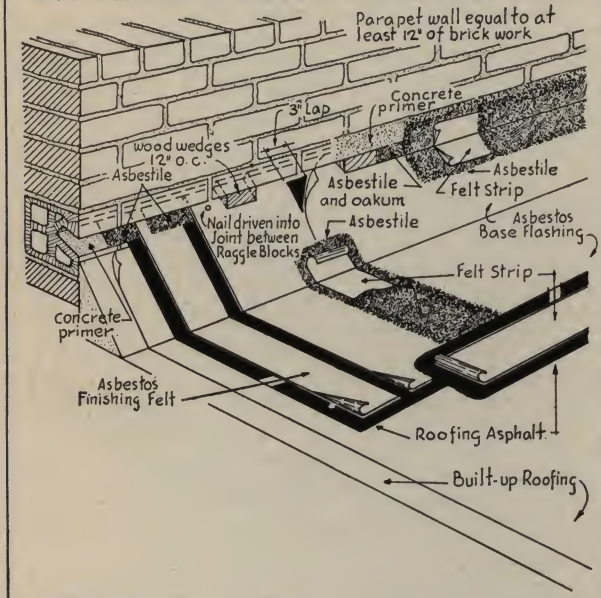
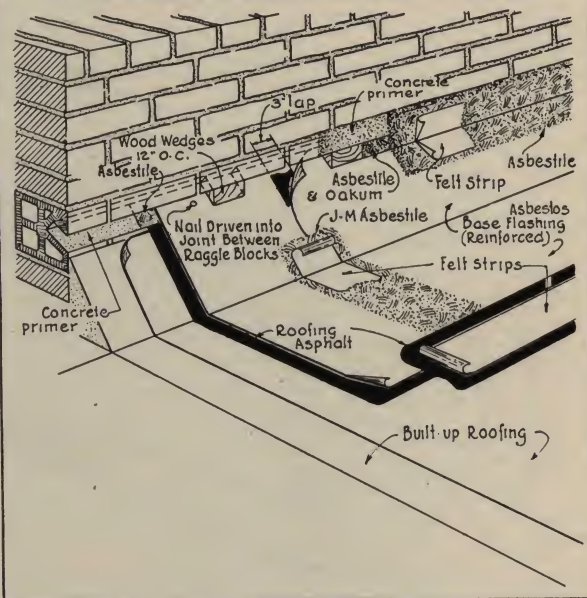
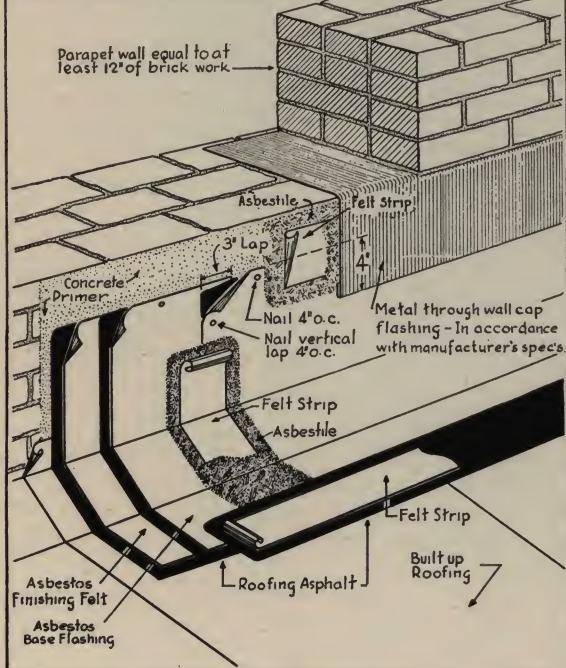
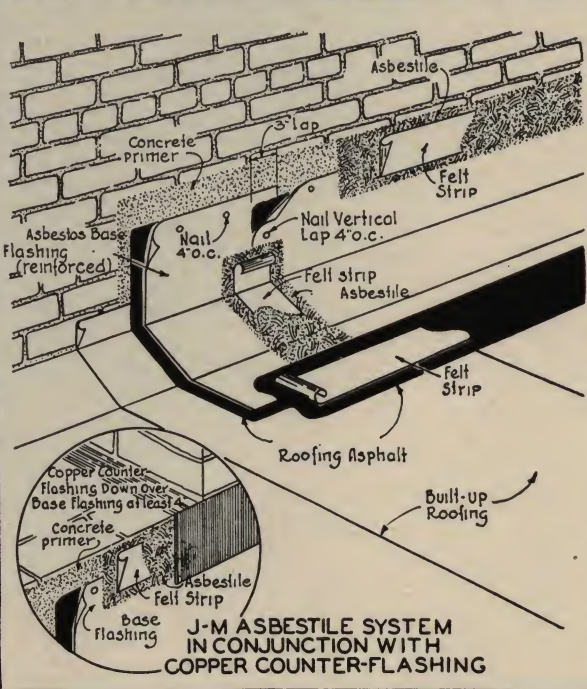




## J-M Base and Cap Flashings





**J-M Base and Cap Flashings—(Continued)****SUPER A ASBESTILE FLASHING SYSTEM WITH RAGGLE BLOCK CONSTRUCTION****METHOD OF INSTALLING J-M FLASHING TO RAGGLE BLOCK IN BRICK WALL****ASBESTILE FLASHING SYSTEM WITH SUPER A BASE AND CAP FLASHINGS AND METAL CAP FLASHING EXTENDED THROUGH BRICK WALL****J-M STANDARD BASE AND CAP FLASHING NOT LESS THAN 8" HIGH****J-M ASBESTILE SYSTEM IN CONJUNCTION WITH COPPER COUNTER-FLASHING**



# J-M Ready-to-Lay Roofings

## Asbestos Ready-to-Lay Roofings

J-M Asbestos Ready-to-Lay Roofings, made of asbestos felt thoroughly impregnated with asphalt, are rot-proof, weatherproof and highly fire-resisting. They are particularly adapted to pitched roofs of factories, many types of industrial buildings, garages, service stations, houses, barns, sheds etc. The roofings are manufactured in three general types: smooth black top, smooth white top, and mineral surfaced. They are packed with galvanized nails, lap cement and butt-lap strips. If specified, they are supplied without nails and cement. The weights given are approximate.

**Flexstone® Smooth-Surfaced Roofing:** This roofing consists of three or four plies of asphalt-impregnated asbestos felt, cemented together with asphalt into heavy, strong sheets. The sheets are furnished with a smooth surface, 32" x 80", six sheets per sq. Three-ply material, designated "Heavy," is packed 5 sq per crate containing sufficient material for 500 sq ft of roof surface. The shipping weights are 75 lb per sq crated, and 53 lb uncrated. Four-ply material, "Extra-Heavy," is packed 4 sq per crate containing sufficient material for 400 sq ft. Weights for shipment are 98 lb per sq crated, and 74 lb per sq uncrated. The Heavy material carries Underwriters' Class B label; Extra Heavy, Class A.

**Flexstone Mineral-Surfaced Roofing:** A heavy asphalt-impregnated asbestos felt, surfaced on one side with red, green, or black mineral granules, especially designed for steep-roofed buildings where color is desired in the finished roof. The material is furnished in 1-sq rolls, 32" wide, with 2" selvage, shipping weight 90 lb and carries the Underwriters' Class B label.

**White Top® Roofing:** This roofing is made of plies of asphalt-impregnated asbestos felts cemented together with asphalt, with a white (unimpregnated) asbestos felt on top. It has been used on many industrial buildings on the back of saw-tooth construction because of its clean, attractive, light-reflecting surface and its fire and weather-resisting properties. White Top Roofing is supplied in three weights: Standard, Heavy and Extra



*Flexstone Smooth-Surfaced Roofing assures an attractive and economical roof*

Heavy, each with about 1½" selvage edge for laps. Standard (3-ply) is furnished in 1-sq rolls, 32" wide, weighing 55 lb per sq and Heavy (3-ply) in 1-sq rolls, 32" wide, weighing 60 lb per sq. Rolls are cut into pieces 13 ft 6" long. Extra Heavy (4-ply) is furnished six flat 32" x 80" sheets per sq 4 sq per crate, weighing 98 lb per sq crated and 72 lb per sq uncrated. Heavy carries the Class B and Extra Heavy the Class A Underwriters' label.

## Asphalt Ready-to-Lay Roofings

Johns-Manville manufactures several types of asphalt roll roofings, with an asphalt-saturated rag felt base, at a somewhat lower cost than the more enduring asbestos roofings. Since the life of rag felt roofing is largely dependent upon the type and quantity of saturant and coating, Johns-Manville uses only those asphalts that best resist the action of sun and weather in order to provide maximum service and durability. Asphalt ready-to-lay roofings are furnished smooth and mineral-surfaced. The weights given are approximate and accessories are shipped as described unless otherwise specified.

### Smooth-Surfaced Asphalt Roll Roofings:

**Smooth Duplex Roofing:** This is the highest type of smooth roll roofing as it offers concealed nailing and two-ply construction. It is finished with a smooth talc surface on both sides. The 36"-wide rolls are laid with

All colors and types are not available in all locations; therefore, consult a J-M office before selection.





*J-M Ready-to-Lay Roofings are particularly adapted to steep-roofed buildings*

17" exposure, with a weather area of 50 sq ft per roll. applied with Duplex Cement and galvanized nails. The roofing itself weighs 43 lb per roll plus 12 lb for nails and cement.

**Pilot-Roofing:** This material, one of the highest quality smooth-surfaced asphalt roofings, is finished with a smooth mica surface on one side and a veined talc surface on the other. It is recommended for steep-roofed buildings. The roofing is furnished in 1-sq rolls (108 sq ft), 36" wide, with lap cement and galvanized nails. Pilot is furnished in Heavy and Extra Heavy weights, 55 and 65 lb per sq respectively. Both weights carry the Underwriters' Class C label.

**Service Roofing:** This is a medium grade asphalt roofing with a veined talc surface on both sides and furnished in 1-sq rolls (108 sq ft), 36" wide. It is available in Medium weight, 45 lb per sq, with bright nails and lap cement.

### ***Mineral-Surfaced Asphalt Roll Roofings:***

Mineral-Surfaced roofings are especially adapted where color is desired in the finished roof. They are manufactured from rag felts heavily saturated and coated with asphalt, with colored mineral granules securely embedded in the asphalt on the upper surface. In the following descriptions, all weights given for the asphalt roofings are approximate.

**Slatekote Roofing:** The standard type of Slatekote is furnished in 1-sq rolls (108 sq ft), 36" wide, with or without 2" selvage edge, depending upon supply point. Lap cement and galvanized nails are included. The roofing, weighs 90 lb per sq and carries the Underwriters' Class C label. Representative colors include Silver Gray, Black, Tile Red, Spruce Green, White, and various Blends and Mixes.

**Slatekote Starting Strips,** for starting shingles, lining valleys and covering hips and ridges, are furnished in rolls, 36-ft long in two widths, 9" and 18", weighing 21 and 42 lb per roll respectively. Starting strips are available in Black, Tile Red, Spruce Green, and various Mixes. Packed without nails or cement.

**19"-Sealap Slatekote Roofing:** This roofing is supplied in narrow width (19") to permit easier handling. It also provides greater wind resistance since the selvage is nailed every 16" up the roof. Furnished in rolls 19" wide by 77 ft 4" long, sufficient for one square, with 3" selvage edge. Sealap Lap Cement and galvanized nails are included. Because of cement, rolls are sold in multiples of two. The roofing, weighing 97 lb per roll, is supplied in Black, Fieldstone Gray and Spruce Green.

**Modernedge Slatekote Roofing:** This variety of Slatekote has a split through the center of the roll in a pyramid pattern to effect thatch-like roof lines. Furnished, depending upon supply point, in 32" or 36"-wide rolls. Both widths are supplied in roll lengths to cover 100 sq ft of weather area when applied with a 2" headlap. Representative colors include Mossfield, Killarney Blendfield, Red Blendfield, Azure Blendfield and other Blends. Supplied without nails or cement, Modernedge Slatekote Roofing weighs 105 lb per sq.

**Slatekote Duplex Roofing:** This style of Slatekote is made 36" wide, with 17" slate surfacing and 19" selvage for cementing, for use where a superior longer-lasting roof is desired and on pitches as low as 1" to the foot where built-up roofing is not available. The 36"-wide rolls cover 50 sq ft weather area, two-ply construction. Applied with galvanized nails and Duplex Cement. Slatekote Duplex roofing weighs 63 lb per roll plus 12 lb for nails and cement. Representative colors include Black, Spruce Green, Tile Red and Silver Gray. Slatekote Duplex Roofing carries the Underwriters' Class C label.

All colors and types are not available in all locations; therefore, consult a J-M office before selection.



## Application of J-M Ready-to-Lay Roofings

### Roof Inclines:

Ready-to-lay roofings are not suitable for use on flat surfaces, nor should they be used on roofs surrounded by parapet walls or other vertical surfaces where stoppage of leader outlets would result in water backing up and lying on the roof. In other words, these roofings should not be used on any surface that cannot be depended upon to drain water freely.

### Roof Surfaces:

Ready-to-lay roofing is usually applied directly over wood sheathing, which should be composed of well-seasoned roof boards, closely laid, preferably tongue and groove, and secured with at least two nails to each bearing. Any boards that warp or curl should be drawn down by re-nailing. Any loose nails should be re-driven, knot holes or cracks covered with tin and the roof cleared of all obstructions and swept clean. This should provide a sound, smooth nailing surface.

In the case of an existing roof of old shingles, it is often advisable to remove the shingles and provide close sheathing to receive the new roofing.

On old tin roofs, if the roof boards are laid close and in good condition, it is better to remove the tin. Application can be made over the tin, however, provided all standing seams and sharp edges are flattened down and nailed before the roofing is applied.

The application is as important as the materials in determining the satisfactory service to be obtained where this type of roof covering is adaptable. Particular attention should therefore be paid to detailed directions for use. See drawings on other side of page.

### Laps:

Roofing is always laid so that water runs over the laps, never against exposed edges. On asbestos roofing, vertical ends laps are either butted or lapped (see table below). If butted, 6" wide strips of roofing felt are centered under the joint. These strips are coated with cement, into which the ends of the roofing felts are firmly embedded and nailed. On asphalt roofing, vertical laps are formed by lapping over the roofing felts and cementing and nailing as required.

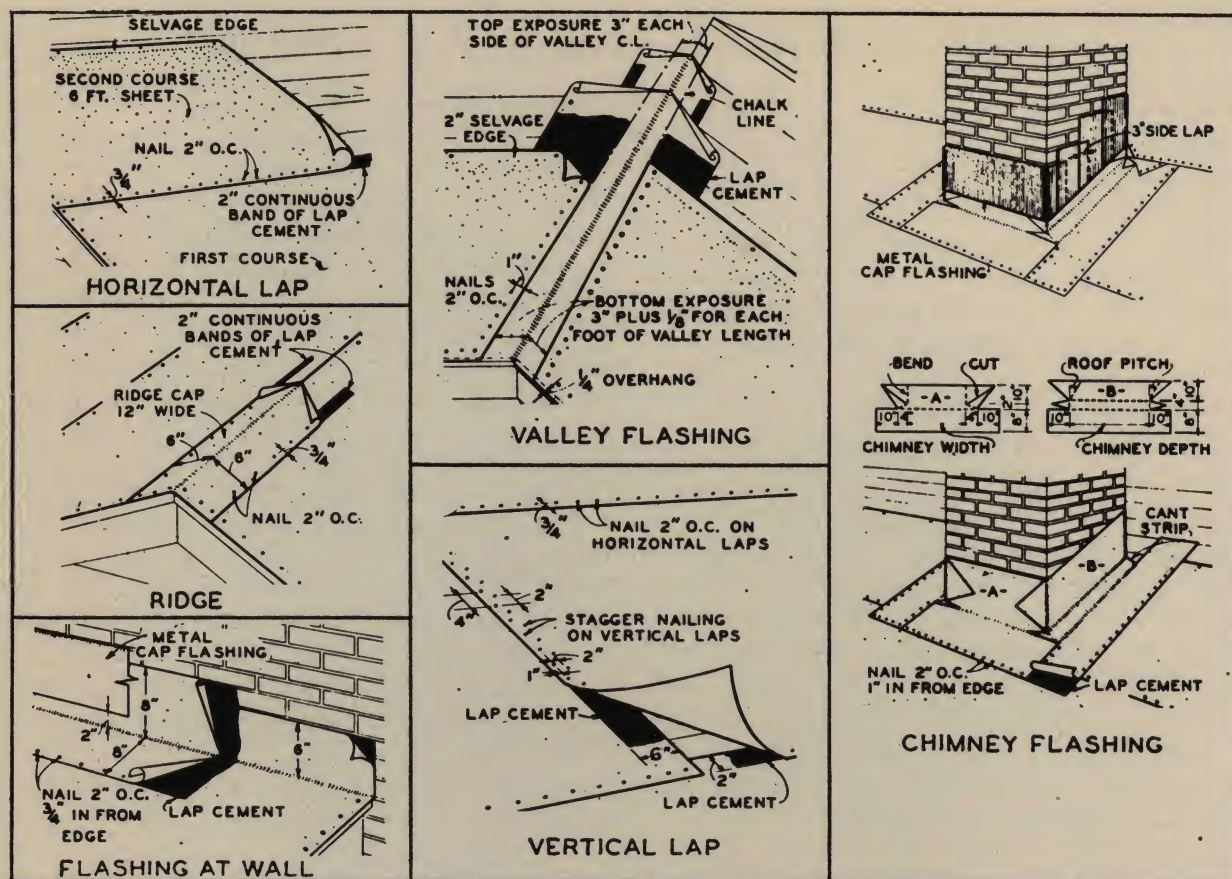
Laps, minimum roof pitches, type of nailing, etc., are summarized in the table below.

*Application Data on J-M Ready-to-Lay Roofing*

Style of Roofing	Minimum Roof Incline per Foot	Laps,		Type of Nailing	Laps Cemented With
		Horizontal	Vertical		
Flexstone Smooth-Surfaced	2" 2"	2" 3"	Butted 6"	Exposed Concealed	Lap Cement Sealap Lap Cement
Flexstone Mineral-Surfaced	3" 2"	2" 3"	Butted 6"	Exposed Concealed	Lap Cement Sealap Lap Cement
White Top	3" 2"	2" 3"	Butted 6"	Exposed Concealed	Lap Cement Sealap Lap Cement
Pilot	3" 2"	2" 3"	6" 6"	Exposed Concealed	Lap Cement Sealap Lap Cement
Service	3" 2"	2" 3"	6" 6"	Exposed Concealed	Lap Cement Sealap Lap Cement
Slatekote	3" 2"	2" 3"	6" 6"	Exposed Concealed	Lap Cement Sealap Lap Cement
Slatekote Duplex	1"	19"	6"	Concealed	Duplex Cement
Smooth Duplex	1"	19"	6"	Concealed	Duplex Cement
19"-Sealap Slatekote	2"	3"	6"	Concealed	Sealap Lap Cement
Modernedge Slatekote	4"	2"	4"	Exposed	No Cement
	2"	3"	6"	Concealed	Sealap Lap Cement
	1½"	4"	6"	Concealed	Sealap Lap Cement

*(Application directions for J-M Ready-to-Lay Roofings appear on other data sheets)*





Typical details (exposed nailing) for Asphalt Ready-to-Lay Roofings

### J-M Roofing Cements and Coatings

**Asbestos Fibrous Roof and Foundation Coating:** An asphalt coating reinforced with asbestos fibers for roofs which have been badly neglected and deterioration is under way to the extent that deep checking is plainly visible. Asbestos Fibrous Roof and Foundation Coating is a protective coating only and must not be used as a cementing agent.

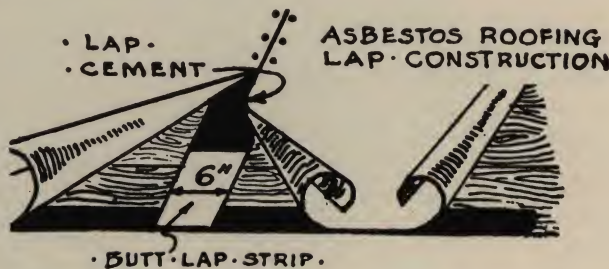
**Black Plastic Cement:** A high grade plastic roof cement made of asbestos fibers and asphalt for repairing cracks and holes on old roofs, or new roofs damaged by accidental blows or roof cracks developing from the unexpected movement of the building itself. Besides roof repairs, Black Plastic Cement is ideal for repairing flashings or for filling breaks in parapets, penthouses and other roof structures.

**Duplex Cement:** This cement is used in the application of Slatekote Duplex and Smooth Duplex ready-to-lay roofings, or similar roofings involving two-ply construction. Duplex cement must never be used with uncoated felts.

**Lap Cement:** Used for cementing the laps of ready-to-lay roofings where exposed nailing is used in application.

**Regal Roof Coating:** A smooth-bodied, asphalt coating for roofs which have started to dry out. By applying a coat every two or three years the life of the roof can be materially lengthened. It is also used for preventing rust and preserving metal roofs. Regal Roof Coating is a protective coating only and must not be used as a cementing agent.

**Roofing Tape:** A waterproofing fabric for use with roof coatings and cements for mending or bridging large cracks or holes in old asphalt roofings. It is furnished in 36-ft rolls, 3" wide.



Vertical lap on asbestos roofings with exposed nailing and cemented laps

**Sealap Lap Cement:** This material is used in cementing the laps of ready-to-lay roofings where the concealed nailing method of application is used.

**Other Materials:** J-M Ready-Mixed Asbestile, Special A.R. Roof Putty, Bonded Roofing Asphalt and Bonded Roofing Pitch are described under Bonded Built-up Roofs; Asbestos Caulking Putty in the section covering "Building Materials"; and Concrete Primer and Standard Asphalt Waterproofing Cement in the "Waterproofing and Miscellaneous Asphalt Products" Section.



## J-M Roof Insulation for use under built-up roofs



*By retarding the passage of heat, J-M Roof Insulation reduces the operating costs of both the heating and air-conditioning systems*

A roof that is only waterproof is similar to a bare steam pipe—both perform their essential function but can be made more efficient by the use of insulation. Like the bare pipe, an uninsulated roof is a source of waste. For this reason, Johns-Manville manufactures Rock Cork\* and Roofinsul,\* both of which are durable sheet materials used as insulation under built-up roofs. These products have also been utilized on several types of J-M insulated roof structures designed for special conditions, such as the prevention of condensation. Roofs of textile mills, cold storage buildings, warehouses, breweries, office buildings, hotels, apartment houses, hospitals and other structures—when insulated—increase their utility as follows:

**Savings on Fuel and Air-Conditioning Costs:** Insulation effectively retards the passage of heat through the roof, thus reducing fuel bills. The extent of this saving can be realized when it is recognized that in winter one-third of the heat loss through uninsulated construction escapes through the roof. Savings in

the original and operating costs of an air-conditioning system are likewise effected as two-thirds of the heat entering in summer comes through the same area.

**More Comfortable Working Conditions:** Insulation of the roof structure permits better control over interior temperatures both in summer and winter, assuring more comfortable and more uniform working conditions. In many modern industrial processes, interiors having uniform temperature are necessary for successful and efficient production.

**Lengthens Life of Built-up Roofing:** When alternate expansion and contraction, caused by temperature changes, continue for a long time, any cracks in the roof deck may eventually be transmitted to the built-up roof. By keeping the temperature of the deck more uniform, an intervening layer of insulation not only minimizes this movement but also is sufficiently resilient to absorb many such strains when movement does occur.

**Prevents Condensation and Roof Drip:** By keeping the temperature of the underside of a roof above

\* Reg. U. S. Pat. Off.



the dew point, insulation of the proper thickness will eliminate condensation and the damage caused by roof drip. This subject is treated on another data sheet entitled "Prevention of Condensation under Roof Decks."

**Protects Decks Against Rot and Corrosion:** The elimination of condensation protects wood and steel decks against rot or corrosion caused by the deteriorating effects of water.

### Rock Cork Roof Insulation

Rock Cork is an excellent insulating material which, because of its composition, will maintain its efficiency indefinitely. It is made of mineral wool combined with a waterproof binder, then moulded into sheet form and backed. Next, the sheet is surfaced on one side with asphalt-saturated rag felt which is applied with a high melting point asphalt and trimmed flush with the insulation.

If wetted, Rock Cork will not rot, support mold or disintegrate. Should water get to it, this roof insulation, which is non-capillary, will not swell or shrink. The inertness of Rock Cork is protection to the built-up roof because there is no warping or expansion pressure to cause damage from underneath.

The ideal bond, felt-to-felt, secures this insulation to the built-up roof, since the felt of the roofing is mopped to the felt of the insulation. When it is laid, the fibrous nature of Rock Cork permits tight joints and the sheets rest on the roof, snugly conforming to irregularities in the deck.

Rock Cork sheets are of a size easy to handle and are sufficiently strong so that large quantities can be applied with practically no breakage. They are furnished 18" x 36", in thicknesses of 1½" and 2". The 2"-thick sheets weigh approximately 2.9 lb per sq ft.

### Roofinsul

J-M Roofinsul is a light weight, efficient insulation made of Southern pine fiber processed into a homogeneous board form. It is economical and easily installed and can be worked in the same manner as wood. Four types are available in sizes 23¾" x 48", and thicknesses of ½", 1", 1½" and 2".

**Coated Weathertite Roofinsul:** Impregnated with an asphalt admixture and then coated with asphalt on all six sides. This treatment assures maximum resistance against mold, fungus growth, and surface mois-

ture penetration. Also, the asphalt coating provides better adhesion with the roofing felts.

**Coated Roofinsul:** Standard Roofinsul coated with asphalt on all six sides.

**Weathertite Roofinsul:** Impregnated with an asphalt admixture but without the asphalt coating.

**Standard Roofinsul:** No impregnant or coating is used with this type.

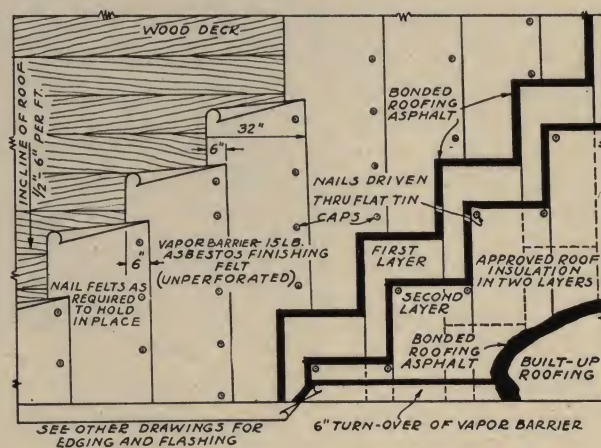
**Weights:** The approximate weights of ½"-thick Roofinsul range from 0.65 lb per sq ft for Standard to 0.85 for Coated Weathertite.

### Application

The representative drawing below shows how Approved Roof Insulation must be applied before being overlaid with J-M Built-up Roofing. More complete information on roof insulation specifications is available on other data sheets.

Either Rock Cork or Roofinsul can be used over wood or non-combustible (except steel) decks of the usual inclines. On steel decks, Roofinsul is required because, being the more rigid of the two materials, it makes a better and firmer bridge between the ribs of the steel deck.

Special Johns-Manville roofs designed to withstand particular conditions are the J-M Insulated Rot-proof Roof and the Transite Insulated Roof. Conditions for which these roofs are best suited are described on other data sheets. Regardless of the type of roof and the material applied, it is important to keep the insulation dry before and during its application.



*Typical application of Approved Roof Insulation over wood decks to be overlaid with J-M Built-up Roofing employing asphalt*



## Prevention of Condensation under roof decks

When air comes in contact with a cooler surface, such as the underside of a roof, its temperature is lowered. If the temperature of the surface is below the dew point of the water vapor in the air, the excess moisture is deposited on the surface as condensation. Insulation of the proper thickness will keep the temperature of the surface above the dew point and prevent the deposition of moisture.

The chart shows the total resistance to heat flow required to prevent condensation under various conditions. This chart and the accompanying tables of resistances can be used to determine the necessary thickness of insulation to accomplish this result.

### *Determination of Insulation Thickness:*

Starting from room temperature on scale A, draw a vertical line to the point representing the relative humidity of the room air. From this point, draw a horizontal line to the point above scale B corresponding to the difference in temperature between inside air and outside air. Reading on the sloping curves, this point represents the total resistance required to prevent condensation.

From Table No. 1, the resistance offered by the roof structure, without insulation, is found, and the difference between this figure and the total resistance required represents the resistance which must be provided by the insulation. The thickness of insulation needed is obtained from Table No. 2. If the resistance falls between that provided by two standard thicknesses of Roofinsul or Rock Cork, the greater thickness should be used.

### *Example—J-M Insulated Rot-proof Roof:*

With a room temperature of 62.5 F, a relative humidity of 80%, and a temperature difference of 50 F

between inside air and outside air, the chart shows that a total resistance of 5.0 is required to prevent condensation. From Table No. 1 the resistance of the J-M Insulated Rot-proof Roof, exclusive of sheet insulation, is found to be 1.49, leaving a resistance of 3.51 to be provided by the Rock Cork which, in the 1" thickness, has a resistance of 3.12. This requires the use of Rock Cork in the next higher thickness, 1½", to prevent condensation.

### *Example—J-M Roofinsul over Steel Deck:*

With the same temperature and humidity conditions used above, and a steel deck with insulation to be overlaid by a smooth-surfaced asbestos built-up roof, the thickness of Standard Roofinsul required is determined as follows:

A total resistance of 5.0 is required, as in the previous example. The resistance of the steel deck and built-up roof is found from the table to be 1.06, leaving a resistance of 3.94 to be provided by the insulation. Reference to Table No. 2 then shows a 1½" thickness of Roofinsul is required to insulate the steel deck properly.

### *Example—J-M Smooth-Surfaced Built-up Roof over Stone Concrete:*

With the same temperature and humidity conditions used above, suppose it were desired to determine how thick stone concrete would have to be, to prevent condensation.

The total resistance of 5.0 must be made up by adding 0.61 inside surface resistance, 0.17 outside surface resistance, 0.28 Built-up Roof resistance, plus the necessary thickness of stone concrete. Dividing 3.94 by 0.08, this thickness is found to be approximately 49".



Regardless of how carefully a wood deck may be constructed, under severe moisture conditions vapors penetrate the planking, condense on the underside of the built-up roof and rot starts at the top, unseen, and works down. The above sectional view of a paper mill roof, after six years service, illustrates this disintegrating action. The J-M Insulated Rot-proof Roof is designed to prevent such failures



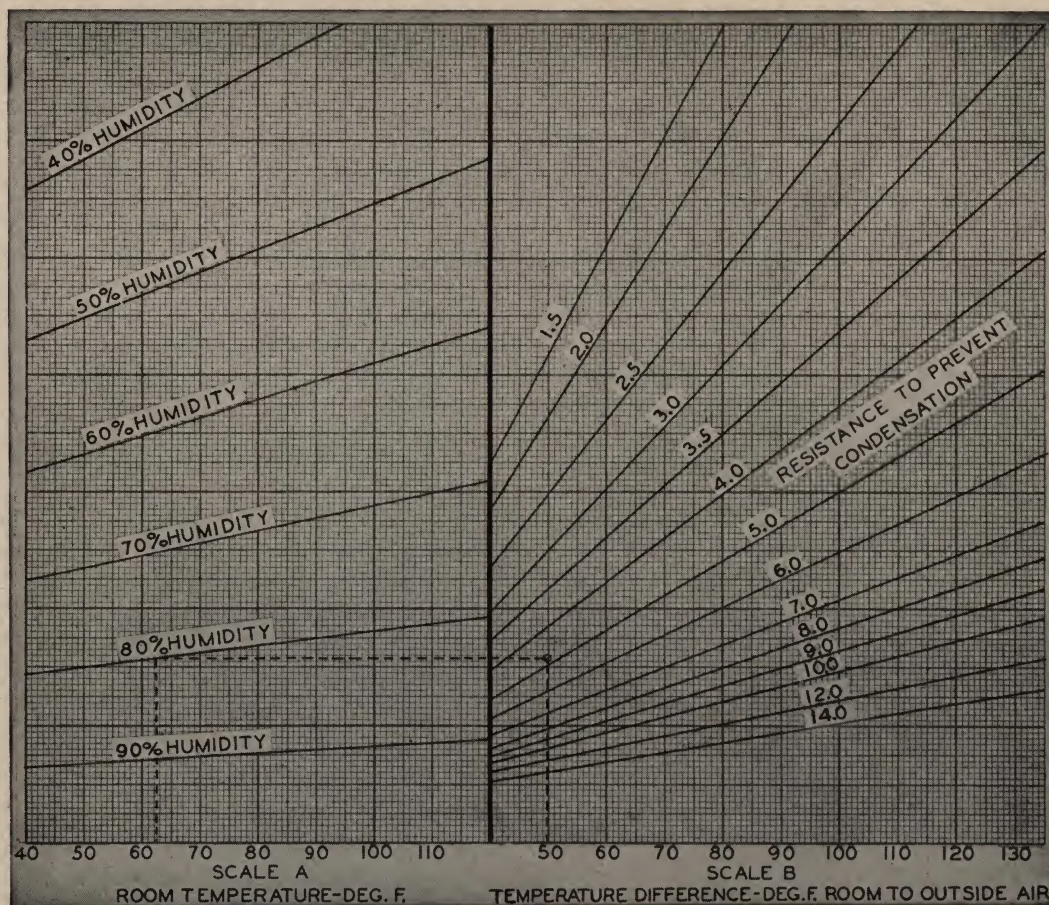


Chart to determine resistance required to prevent condensation\*\*\*

Table No. 1—Resistances of Uninsulated Roof Structures covered with Smooth-Surfaced Built-up Roofs

	Resistance
J-M Insulated Rot-proof Roof (exclusive of sheet insulation) . . . . .	1.49
Cement tile, 1 $\frac{5}{8}$ " thick, precast . . . . .	1.19
Concrete (stone) 4" thick . . . . .	1.39
Concrete (stone) 6" thick . . . . .	1.54
Gypsum tile, 3" thick, solid . . . . .	2.08
Gypsum concrete, 3", over $\frac{1}{2}$ " gypsum board . . . . .	3.23
Steel . . . . .	1.06
Wood, 2 $\frac{5}{8}$ " thick (nominal 1") . . . . .	2.04
Wood, 1 $\frac{5}{8}$ " thick (nominal 2") . . . . .	3.12
Wood, 2 $\frac{5}{8}$ " thick (nominal 3") . . . . .	4.35

\*These resistances are per inch. Multiply by thickness in inches to obtain total resistance.

\*\*Total resistance, based on actual thickness.

Table No. 2—Resistance of Materials and Surfaces

	Resistance
Cement tile (precast) . . . . .	0.08*
Concrete (cinder) . . . . .	0.22*
Concrete (stone) . . . . .	0.08*
Corkboard . . . . .	3.33*
Gypsum tile (solid, 68 lb per cu ft) . . . . .	0.34*
Gypsum fiber concrete (typical) . . . . .	0.60*
Gypsum Board, $\frac{3}{8}$ " thick . . . . .	0.27**
Roofinsul (Standard) . . . . .	2.78*
Rock Cork Roof Insulation . . . . .	3.12*
Transite, $\frac{3}{8}$ " thick (flat or corrugated) . . . . .	0.08**
Wood (yellow pine or fir) . . . . .	1.25*
Built-up Roof, Smooth-Surfaced . . . . .	0.28**
Inside surface resistance . . . . .	0.61
Outside surface resistance . . . . .	0.17

\*\*\*This chart is applicable only if a vapor barrier is installed on the underside of the roof deck.

Except as noted, resistances in the above table for other than J-M Materials are as recommended in the A. S. H. & V. E. Guide



## J-M Insulated Rot-proof Roof\*



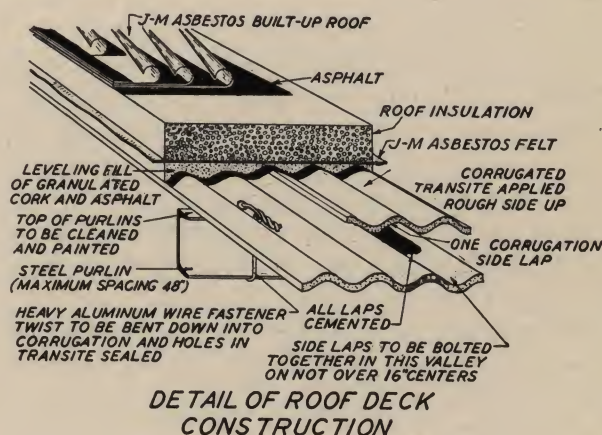
*Application of insulation over felt and leveling fill of a J-M Insulated Rot-proof Roof. To determine the thickness of insulation required to prevent condensation, see data sheet entitled "Prevention of condensation under roof decks"*

While the J-M Insulated Rot-proof Roof was especially designed to withstand the severe moisture, heat and acid conditions encountered over the machine room in paper mills, it is equally suited to other industrial buildings where similar conditions soon destroy the ordinary roof deck.

Regardless of how carefully a wood deck may be constructed, vapors penetrate the planking, condense on the underside of the built-up roof and rot starts at the top, unseen, and works down. While the problem of rot can be eliminated by the use of concrete, that of condensation and roof-drip remains.

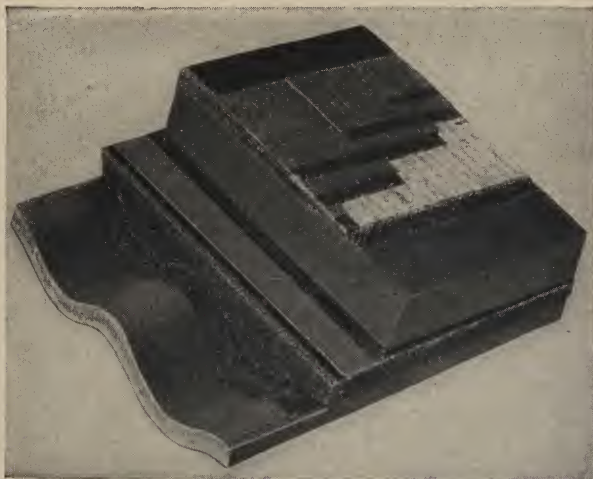
The J-M Insulated Rot-proof Roof consists of Corrugated Transite supported on steel purlins or wood rafters, a leveling fill of cork mastic, a ply of asbestos felt, an approved sheet insulation having the required thickness, and a J-M Asbestos Built-up Roof. This

construction meets all the requirements of an ideal roof for paper mill service. The particular advantages of this assembly are enumerated on the reverse of this page. Construction details are on another data sheet.



\* Patented in United States.





*Construction of a J-M Insulated Rot-proof Roof*

### Advantages of Rot-proof Roof

1. Waterproof on both sides. The construction is inherently water-resistant.
2. High Insulating qualities. The thickness of insulation is varied, according to conditions, as may be required to prevent condensation. The heat trans-

mission through this roof is less than one-third that through wood of equal thickness. The need for special air-conditioning or ventilating systems is reduced through its use. The insulation value of the J-M roof will not be impaired during long years of service.

3. Fire-resisting. The materials as they are employed afford a highly fire-resistant construction.

4. Rot-proof. Because of its thorough water-tightness, no moisture can penetrate the J-M Insulated Rot-proof Roof.

5. Acid-resisting. The roof is unaffected by the acid fumes encountered in paper mill service.

6. Floating construction. The roof is so secured to the steel work that both are allowed to move independently, providing a floating roof construction.

7. Light weight: The construction, exclusive of the steel work, weighs about 8 lb per sq ft plus  $1\frac{1}{4}$  to  $1\frac{3}{4}$  lb per sq ft per inch thickness of sheet insulation used.

8. Low maintenance. The J-M Insulated Rot-proof Roof can be depended upon for many years of service with practically no maintenance.

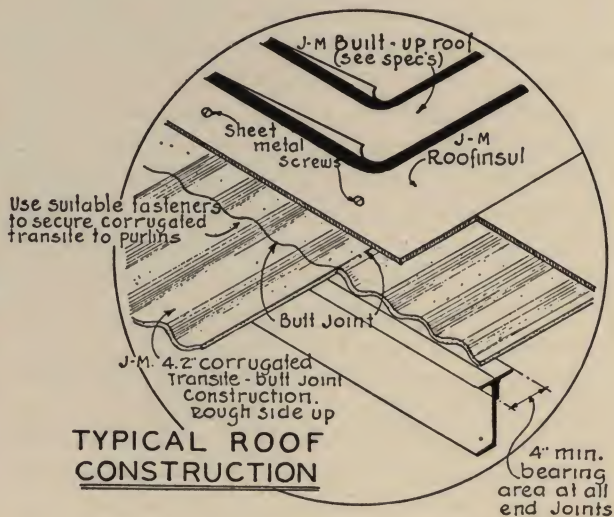
## Transite Insulated Roof

Where roof insulation is desired, but condensation conditions are not severe, a less expensive construction than the Insulated Rot-proof Roof, known as the Transite Insulated Roof, has given satisfactory service under widely varying climatic conditions.

This construction uses, as the roof deck, Corrugated Transite over which is applied a minimum of one 1-inch thick layer of Roofinsul, which serves as a base for a standard J-M Built-up Roof.

The Corrugated Transite, laid rough side up, with all edges butted, is bolted to the purlins. A minimum of one inch of Roofinsul is applied over it with all joints staggered, the layers being secured together as a unit deck, using bolts or sheet metal screws. Large washers are used under the heads and the fasteners drawn tightly enough to imbed the heads slightly and leave a flat upper surface. Over the Roofinsul, the type of J-M Built-up Roof selected is applied in accordance with standard J-M specifications. Detailed

construction drawings are reproduced on other data sheets, available on request.





## J-M Asbestos Roofing and Siding

Johns-Manville Asbestos Roofing and Siding Products are designed to fulfill the basic physical requirements of the extremes of weather protection, fire-resistance and durability; to provide character and distinction in appearance; and to meet the problems of economy and easy application.

These products include rigid asbestos roofing and siding shingles, and Colorbestos® siding sheets. All are made of two practically indestructible materials, asbestos and cement. The asbestos fibers serve as a reinforcing agent in the cement, providing a strong, rigid monolithic product which retains the ruggedness and permanence of stone. Such asbestos-cement products will not rot, rust or decay, and are unaffected by high temperatures or damp, humid, freezing and thawing conditions. Also, the rigidity of the materials is an important factor in areas subject to high winds.

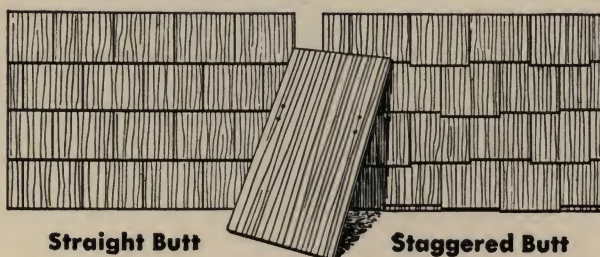
A wide choice of color blends makes possible the most effective harmony between buildings and surrounding landscapes, and to meet the trend toward colorful roofs and sidings.

### Asbestos Roofing Shingles

J-M Asbestos Roofing Shingles are furnished in uniform thickness. They are manufactured in three styles: American Method, Hexagonal and Dutch Lap.

For the American Method, J-M supplied the large size asbestos strip shingle and the individual Salem asbestos shingle.

**No.50 Salem Shingle:** This rigid asbestos, individual American Method shingle is an ideal shingle for a rugged, permanent type, fire-resistant roof for churches, schools, public buildings and custom-built homes. It can be laid with either straight or staggered butts. Nail holes for both methods of application are pre-punched. The extra thickness of this Salem shingle provides the



*The J-M No.50 Salem is the finest American Colonial Asbestos Shingle. The shingle is pre-punched so that it can be laid with either straight or staggered butts*



*J-M No.607 American Colonial Asbestos Shingles are durable, attractive and economical*

desirable architectural effect of a heavy shadow line that adds to the distinction of any building. The pleasing textured surface and the rich colors are lasting.

**No.607 American Colonial Shingle:** This shingle obtains the American Method pattern at a moderate cost. The staggered butt line gives the appearance of 5 individual shingles and the large units (30" x 14") afford economies of application.

**Hexagonal and Dutch Lap Shingles:** Where economy is a governing factor, the Hexagonal or Dutch Lap Method shingles may be used. Owing to their shape, size and manner in which they are laid, these shingles provide full protection with a minimum of materials, at relatively low cost.

The finished roof of Dutch Lap shingles gives the horizontal and vertical effect of the American Method.

The Hexagonal-Shingled roof presents the diagonal-line effect found on old French cottages.

### Asbestos Siding Shingles

Johns-Manville Asbestos Siding Shingles are comparable to the asbestos roofing shingles in fire resistance and attractiveness. They meet the trend for side-walls in soft pastel shades as well as the standard, ever-popular, textured white. The colorful ceramic granules embedded into the asbestos-cement surface add to ruggedness and weathering qualities of the siding.

In addition, the Asbestos Siding Shingles are manufactured with the J-M Silicone-Sealed Treatment which offers even greater resistance against dirt, stains, peeling, scuffing, and provides maximum retention of initial color appearance after long exposure.

PRODUCT INFORMATION IS SUBJECT TO FREQUENT CHANGE. THE EXACT DETAILS AND AVAILABILITY AT PARTICULAR LOCATIONS SHOULD BE CHECKED WITH THE NEAREST JOHNS-MANVILLE OFFICE





*Charm and variety found in textured wood are an inherent part of J-M Asbestos Siding Shingles*

The types available include the standard size (12" x 24") siding shingles with wavy or straight butts, and the large-size Colorbestos siding shingle which covers two 16"-stud spaces.

### Colorbestos Siding Sheets

Colorbestos Siding Sheets, the newest Johns-Manville asbestos siding, meet the modern trend in house design and economy of construction. The large sheets (32" x 96") are strikingly grained and supplied in a wide choice of color blends.

As with asbestos shingles, the color and texture are built right into the sheet. The texture of Colorbestos runs vertically and parallel with the 8-foot length of the sheet. The striated or ribbed pattern of varying width and color intensity gives the appearance of ingrained texture, yet the surface of the sheet is smooth to the touch. This smoothness resists soiling. The variable-width texture not only presents an attractive appearance, but serves to make the joints and nail heads practically invisible.

Colorbestos is free from objectionable warping or shrinkage and opening of joints. Because the sheet is the same thickness throughout, uniform workability is maintained. One man can handle and place with ease a full size sheet (36 lb) of Colorbestos. It can be rapidly installed since only 4.7 sheets are needed per 100 sq ft of finished siding.

While Colorbestos serves primarily as an exterior wall finish applied vertically from sill to plate, it is equally adaptable for soffits or exterior ceilings. When used on soffits the direction of the striations should correspond with those of the vertical surface to provide the most attractive appearance. Colorbestos may be combined effectively with asbestos shingles and other building materials, such as masonry and wood.

Since it is always applied over conventional sheathing, Colorbestos has high impact resistance.

### Application

Complete directions for the application of J-M Rigid Asbestos Shingles and Colorbestos appear elsewhere. The following paragraphs merely summarize the important details for proper application.

**Roofing Shingles:** The shingles should not be applied over a wet or damp roof deck. When a job is left partially complete, felt should be laid over the topmost applied courses to prevent rain from running down underneath the shingles.

The minimum roof pitch for asbestos roofing shingles is 4" to the foot.

Boards on new roofs should be dry, well seasoned, of narrow width and uniform thickness, laid close (tongue and grooved preferred), and nailed with at least two nails at each bearing. Apply one layer of J-M Asbestos Slaters Felt horizontally before laying the shingles.

When applying asbestos shingles over old wood shingles, missing shingles must be replaced and loose and curled shingles firmly nailed. After the surface is made as uniform as possible, apply J-M Asbestos Slaters Felt before the new shingles are laid.

**Siding Shingles:** When application is to be made over existing wood shingles or clapboards, loose and curled siding must be firmly nailed, decayed siding replaced and horizontal filler strips nailed against the butt edges of the existing siding or shingles. In some instances it may be more economical to remove existing siding down to the wood sheathing.

Work then proceeds in the same manner as over new sheathing, using J-M Asbestos Slaters Felt applied over the side wall. A cant strip is placed along the bottom of the side wall before the first course is applied.

**J-M Shingle Backer** (Asphalt-impregnated J-M Insulating Board) can also be used as an under course to provide a much deeper and more desirable horizontal shadow line.



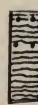
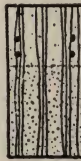
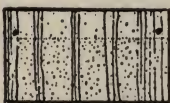

**Colorbestos:** Colorbestos sheets are applied over a continuous backing of wood or non-wood sheathing. The 32" width covers two 16" stud spaces, and presents an unbroken surface from sill to plate. The sheets are applied with the vertical joints butted. Horizontal joints are lapped or may be butted using a non-corrodible "Z" type metal flashing. Exterior corners may be finished with either wood or metal trim. Each sheet has thirty-three nail holes, 1/8" diam, pre-punched along the sides and down the center. Studs should be centered behind all vertical joints, and accurately spaced where non-wood sheathing is used.

A No.15 Asphalt-Saturated Felt is applied over both wood and non-wood sheathing prior to the application of the Colorbestos Siding Sheets.

Asbestos Roofing and Siding is sold by the square, which means sufficient material to cover 100 sq ft of surface when applied in accordance with manufacturer's directions.



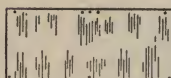

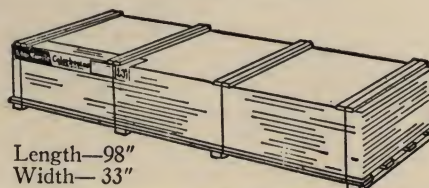
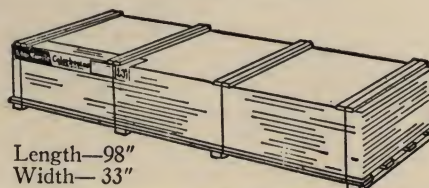
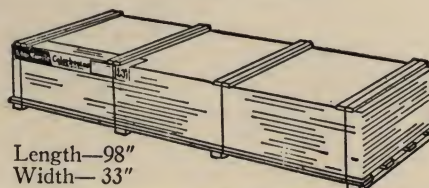


[From Manville (M), N. J.; Waukegan (W), Ill.; Marrero (G), La.; and Fort Worth (E), Tex. Plants]

Shape	Catalog Number and Description	Colors	Plants	Unit	Approx. wt, lb
	<b>No. 607 American Colonial (American Method)</b> Size—30" x 14" Uniform thickness, approx. $\frac{5}{32}$ " Exposure—6" Headlap—2" Shingles per square—80 Shingles per bundle—16 Galv. nails required per sq For new work— $1\frac{3}{4}$ lb $1\frac{1}{4}$ " For reroofing— $2\frac{1}{2}$ lb 2" Requires No. 636 Starters and No. 697 Hip and Ridge Shingle	<b>Smoothgrain</b> Silver Gray <b>Cedargrain Texture</b> Weathered Green Blend Brown Blend Touraine Red Blend Black Blend Green Blend Permatone White Copper Blend Red Blend Dover White	<b>MWGE</b>   <b>MWGE</b>   <b>MW W GE GE</b>	sq	300; Dover White, 290
	<b>No. 636—Starter</b> For use with No. 607 Shingle Size—30" wide Uniform thickness Pieces per 100 lin ft—40 Pieces per bundle—20	(Appropriate Matching Colors)	(Same as No. 607 Shingle)	100 lin ft	70; Dover White, 67
	<b>No. 697—Hip and Ridge Shingle</b> For use with No. 607 Shingle Size— $4\frac{3}{4}$ " to $5\frac{3}{8}$ " wide by 14" long Uniform thickness Pieces per 100 lin ft—340 Pieces per bundle—34 Exposure—7"	(Appropriate Matching Colors)	(Same as No. 607 Shingle)	100 lin ft	275; Dover White, 265
	<b>No. 50 Salem Shingles (American Method)</b> Size—8" x 16"—Trimmed all sides Uniform thickness, approx. $\frac{1}{4}$ " Exposure—7" Headlap—2" minimum Shingles per square—260 Shingles per bundle—20 Galv. nails required per square For new work, 3 lb $1\frac{1}{2}$ " For reroofing, 4 lb 2" Requires No. 51 Starters and No. 57 Hip and Ridge Shingles	<b>Cedargrain Texture</b> Black Red Green Brown	<b>MWG</b>	sq	600
	<b>No. 51 Salem Starters</b> For use with No. 50 Salem Shingles Size—9" x 16"—Trimmed all sides Uniform thickness, approx. $\frac{1}{4}$ " Pieces per 100 lin ft—75 Pieces per bundle—15	<b>Cedargrain Texture</b> Black Red Green Brown	<b>MWG</b>	100 lin ft	195
	<b>No. 57 Salem Hip and Ridge Shingles</b> For use with No. 50 Salem Shingles Size— $4\frac{3}{4}$ " to $5\frac{3}{8}$ " wide by 14" long Trimmed all sides Uniform thickness, approx. $\frac{1}{4}$ " Pieces per 100 lin ft—340 Pieces per bundle—17 Exposure—7"	<b>Cedargrain Texture</b> Black Red Green Brown	<b>MWG</b>	100 lin ft	440




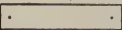


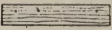
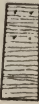
# J-M Asbestos Siding

Shape	Catalog Number and Description	Colors	Plants	Unit	Approx. wt, lb			
	<b>No. 105—Siding Shingles (Silicone Sealed)</b> Size—12" x 24" Uniform thickness, approx. $\frac{5}{32}$ " Exposure—24" x 10½" Shingles per square—57 Shingles per bundle—19 Backer strips and Aluminum Face nails furnished in sufficient quantity.	<b>Smoothgrain Permatone</b> Heather Green Autumn Brown Silver Gray Pastel Green Pastel Sun Tan Pastel Coral Valley Green  <b>Cedargrain Texture</b> Dover White	<b>MWGE</b>	sq	185			
	<b>No. 109—Siding Shingles (Silicone Sealed)</b> Size—12" x 24" Uniform thickness, approx. $\frac{5}{32}$ " Exposure—24" x 10½" Shingles per square—57 Shingles per bundle—19 Backer strips and Aluminum Face nails furnished in sufficient quantity.	<b>Smoothgrain Permatone</b> Heather Green Autumn Brown Silver Gray Pastel Green Pastel Sun Tan Pastel Coral Valley Green  <b>Cedargrain Texture</b> Dover White	<b>MWGE</b>	sq	185			
	<b>No. 309 Colorbestos Shingles (Silicone Sealed)</b> Size—14⅝" x 32" Uniform thickness, approx. $\frac{3}{16}$ " Exposure—32" x 13⅝" Shingles per square—33 Shingles per bundle—11 Backer strips and Aluminum Face nails furnished in sufficient quantity.	<b>Smoothgrain</b> Permatone White Silver Gray Sage Green Desert Brown	<b>MW</b>	sq	200			
	<b>Colorbestos Siding Sheets</b> Size—32" x 96" Uniform thickness, approx. $\frac{3}{16}$ " Sheets per square—approx. 4.7 Sq ft per sheet—approx. 21.33 Weight per sheet—approx. 36 lb Weight of pallet—approx. 65 lb Backer strips in sufficient quantity for application of one square included. Packaged and shipped separately. (Weight—Approx. 31 lb per pkg.) Approx. 170 non-corrodible face nails required per square.	<b>Smoothgrain</b> Heather Green Autumn Brown Light Gray Honey Yellow Blue Gray Indian Red Weathered Gray	<b>MW</b>	sq	170 (Without pallet)			
<table><tr><td><b>Number of Squares per Pallet</b> 11 Sq or More—Max. 18 9.35—10.85 7.65—9.15 5.95—7.45 4.25—5.75 2.55—4.05 0.21—2.35</td><td><b>Full Size Sheet Equivalent</b> 52 Sheets or More 44-51 36-43 28-35 20-27 12-19 1-11</td><td><b>TYPICAL PALLET</b>  Length—98" Width—33"</td></tr></table>						<b>Number of Squares per Pallet</b> 11 Sq or More—Max. 18 9.35—10.85 7.65—9.15 5.95—7.45 4.25—5.75 2.55—4.05 0.21—2.35	<b>Full Size Sheet Equivalent</b> 52 Sheets or More 44-51 36-43 28-35 20-27 12-19 1-11	<b>TYPICAL PALLET</b>  Length—98" Width—33"
<b>Number of Squares per Pallet</b> 11 Sq or More—Max. 18 9.35—10.85 7.65—9.15 5.95—7.45 4.25—5.75 2.55—4.05 0.21—2.35	<b>Full Size Sheet Equivalent</b> 52 Sheets or More 44-51 36-43 28-35 20-27 12-19 1-11	<b>TYPICAL PALLET</b>  Length—98" Width—33"						



**J-M Hexagonal and Dutch Lap Method Asbestos Roofing Shingles**

[From Marrero (G), La.; and Fort Worth (E), Tex. Plants]

Shape	Catalog Number and Description	Colors	Plants	Unit	Approx. wt, lb
	<b>No. 70-Hexagonal Method</b> Size—16" x 16" Uniform thickness, approx. $\frac{5}{32}$ " Exposure—13" x 13" Shingles per sq—86 Shingles per bundle—Alternate 21-22 Gal. nails per sq—1 lb $1\frac{1}{4}$ " Copper Storm anchors per sq—86 Requires No. 17 and No. 71 starters Underwriters' Class B label	<b>Smooth Surface</b> Mottled Gray Red Green Dover White  <b>Diagonal Cedargrain Texture</b> Black Blend	GE	sq	240
	<b>No. 17-Starter</b> For use with No. 70 shingles Size—16" x 4" Uniform thickness, approx. $\frac{5}{32}$ " Pieces per 100 lin ft—75 Pieces per bundle—15	(Mixed Colors)	GE	100 lin ft	54
	<b>No. 71-Eaves Shingles</b> For use with No. 70 shingles Size—20 $\frac{7}{8}$ " wide Uniform thickness, approx. $\frac{5}{32}$ " Shingles per 100 lin ft—58 Shingles per bundle—15	(Same as No. 70 Shingle)	GE	100 lin ft	98
	<b>No. 40-Dutch Lap Method</b> Size—16" x 16" Uniform thickness, approx. $\frac{5}{32}$ " Headlap—3" Sidelap—4" Shingles per sq—92 (Actual coverage—99 $\frac{1}{3}$ sq ft) Shingles per bundle—23 Galv. nails per sq—1 lb $1\frac{1}{4}$ " Copper Storm anchors per sq—92 Requires No. 41 starters (Can also be applied with $\frac{1}{3}$ sidelap requiring 104 shingles per sq) Underwriters' Class B label	<b>Cedargrain Texture</b> Mottled Gray Black Blend Red Green Dover White	GE	sq	265
	<b>No. 41-Starter</b> Size—3" x 16" 100 pcs. per 100 lin ft (4" lap) Packed 20 pcs. per bundle	(Mixed Colors)	GE	100 lin ft	50
	<b>No. 697-Hip &amp; Ridge Shingle</b> For use with No. 70 and No. 40 shingles Size—4 $\frac{3}{4}$ " to 5 $\frac{3}{8}$ " wide by 14" long Uniform thickness, approx. $\frac{5}{32}$ " Shingles per 100 lin ft—340 Shingles per bundle—34 Exposure—7"	<b>Cedargrain Texture</b> Mottled Gray Black Blend Red Green Dover White	GE	100 lin ft	255










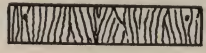


## J-M Asbestos Shingles Available from Pittsburg Plant

## Asbestos Roofing Shingles


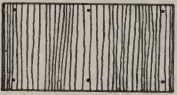
Shape and Style	Texture and Colors	Size, in.	Exposure in.	Shingles per sq	Approx. wt, lb per sq	Starters and Ridge Shingles
 <b>No. 407 Extra Heavy American Colonial</b>	<b>Cedargrain Texture</b> Weathered Green Blend Brown Blend Touraine Red Blend Black Blend Copper Blend	14 x 30 Uniform thickness	6	80	430	No. 436 Starter No. 497 Hip and Ridge Shingle
 <b>No. 607 American Colonial</b>	<b>Smoothgrain Texture</b> Silver Gray  <b>Cedargrain Texture</b> Weathered Green Blend Brown Blend Touraine Red Blend Black Blend Green Blend Copper Blend Red Blend Permatone White	14 x 30 Uniform thickness	6	80	300	No. 636 Starter No. 697 Hip and Ridge Shingle
 <b>No. 80 Dutch Lap</b>	<b>Cedargrain Texture</b> Black Blend Copper Blend Green Blend Silver Gray Blend Permatone White	12 x 24 Uniform thickness	9	80	250	No. 81 Starter No. 697 Hip and Ridge

## Starters and Ridge Shingles

Shape and Style	Texture and Colors	Size, in.	Pieces per 100 linear ft	Approx. wt, lb 100 linear ft
 <b>No. 436 and No. 636 Starters</b>	Matching Textures and Colors	30 wide Uniform thickness	40	100 for No. 436 70 for No. 636
 <b>No. 497 and No. 697 Hip and Ridge Shingles</b>	Matching Textures and Colors	4 <sup>19</sup> / <sub>32</sub> to 5 <sup>11</sup> / <sub>32</sub> wide by 14 long Uniform thickness	340	440 for No. 497 260 for No. 697
 <b>No. 81 Starter</b>	Cedargrain Assorted Colors	3 x 24 Uniform thickness	60	45



*Asbestos Siding Shingles*


Shape and Style	Texture and Colors	Size, in.	Exposure in.	Shingles per sq	Approx. wt, lb per sq
 <b>No. 105 Wavy Butt</b>	<b>Smoothgrain Permatone</b> Heather Green Autumn Brown Silver Gray White	24 x 12 Uniform thickness	24 x 10½	57	185
 <b>No. 109 Straight Butt</b>	<b>Smoothgrain Permatone</b> Heather Green Autumn Brown Silver Gray White Pastel Green Pastel Sun Tan Pastel Coral	24 x 12 Uniform thickness	24 x 10½	57	185




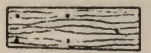
*Constructed of J-M Asbestos Roofing and Siding Shingles, the exterior of this cottage is fireproof and will not deteriorate or require periodic painting*




**J-M Asbestos Shingles Available from Asbestos Factory****Asbestos Roofing Shingles**

Shape	Catalog No.-style	Size	Type	Colors	Approx. wt. lb. per sq.	Weather exposure	Shingles per sq.	Starters and Ridge Shingles
	No. 607 Durabestos (American Method)	14" x 30"	Uniform thickness	Gray blend Black blend Red blend Green blend	290	6"	80	No. 636 starter No. 697 hip and ridge shingle

**Starters and Ridge Shingles**

Shape	Catalog number and style	Size	Type	Colors	Pieces per 100 linear ft.	Approx. wt. lb. 100 linear ft.
	No. 636 starter—Used with No. 607 Durabestos shingle	30" wide	Uniform thickness	Same as No. 607 Durabestos shingle	40	65
	No. 697 hip and ridge shingle—Used with No. 607 Durabestos shingle	4 $\frac{19}{32}$ " to 5 $\frac{11}{32}$ " by 16" long	Uniform thickness	Same as No. 607 Durabestos shingle	340	300

**Asbestos Siding Shingles**

Shape	Catalog number	Size	Type	Colors	Texture	Approx. wt. lb. per sq.	Exposure	Shingles per sq.
	105-U	12" x 24"	Uniform thickness	Blended gray Dover white	Cedargrain	185	10 $\frac{1}{2}$ " x 24"	57

J-M Asbestos Shingles are equally adaptable for application on new structures or for re-roofing and re-siding







*The attractive J-M Durabestos roofing shingle is as economical and simple to apply as an asphalt strip shingle*



## J-M Asphalt Shingles



*J-M Asphalt Shingles provide long years of service at moderate cost*

Johns-Manville Asphalt Shingles, made to the highest standard of quality, are produced in modernly equipped plants strategically situated so that the shingles are readily available through distributors and dealers in all parts of the country.

The shingles are made from a base of selected felt of J-M's own manufacture which is saturated and then coated with refined asphalts. Into the coating, colorful fireproof mineral granules are firmly embedded. When applied as roofing, J-M Asphalt Shingles carry the Underwriters' Class C label.

The various styles, colors and blends, make possible the most effective harmony between the house and landscape. The shingle styles include Seal-O-Matic®, Thick Butt, Giant Strip, Giant Unit, Hexagonal, Weatherlok® and Metalok®.

**Seal-O-Matic Asphalt Strip Shingles:** This three-tab strip shingle is manufactured with the new and patented Johns-Manville automatic sealing against wind and weather. They also possess the traditional attractiveness of straight, extra heavy butts casting strong shadow lines. The self-sealing is effected by a ribbon of asphaltic adhesive approximately  $\frac{3}{4}$  inches wide and located  $\frac{1}{4}$  inch up from the butt edge. After application, the heat of the sun causes the adhesive to soften and merge with the shingle underneath.

**Thick Butt Asphalt Strip Shingles:** Each strip has three square-cut butts or tabs which are made extra

heavy by second coatings of asphalt and mineral granules—assuring double protection on exposed butts.

**Giant Strip Asphalt Shingles:** So named because of their extra thickness and weight. The entire surface of this three-tab strip is twice coated with asphalt and mineral granules to provide strength and durability.

**Giant Unit Asphalt Shingles:** These shingles, of the individual type, can be laid American Method (most commonly used for new work) or Dutch Lap Method (usually for application over old roofs). They are treated and coated the same as the asphalt-strip shingles.

**Hexagonal Asphalt Shingles:** Of the strip type, with either three or two projecting tabs which, when laid, produce an attractive hexagonal pattern.

**Double-Coverage Weatherlok Asphalt Shingles:** Individual type shingles so designed that each shingle is locked to the adjacent shingles at four points in addition to the customary nailing. They provide two thicknesses of heavy-duty shingles over the entire roof—triple thick at corners and head. They are particularly engineered to withstand violent weather and to provide long service.

**Standard Weatherlok Asphalt Shingles:** These individual type shingles are designed primarily for re-roofing work. Their unique shape and method of application offer maximum resistance to wind and weather. Their method of locking is the same as the Double-Coverage Weatherlok.

PRODUCT INFORMATION IS SUBJECT TO FREQUENT CHANGE. THE EXACT DETAILS AND AVAILABILITY AT PARTICULAR LOCATIONS SHOULD BE CHECKED WITH THE NEAREST JOHNS-MANVILLE OFFICE



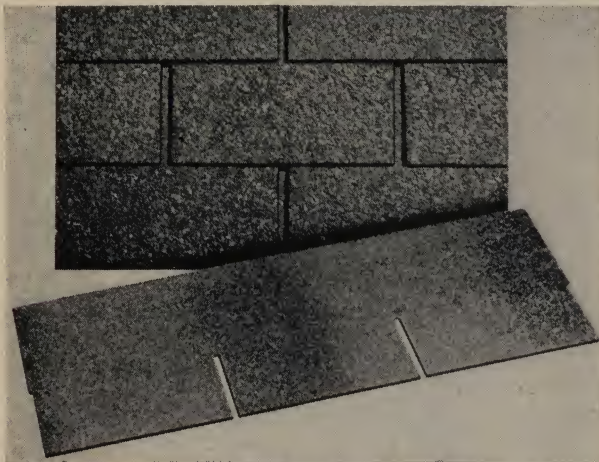
**Metalok Asphalt Shingles:** Metalok shingles, of the individual type and designed primarily for re-roofing, are so named because a metal staple at the butt end locks the shingles together for resistance against wind and weather. Their special shape offers maximum coverage at minimum price. Depending upon the type or weight of the material, they are called Giant Metalok or Standard Metalok.

### Application of J-M Asphalt Shingles

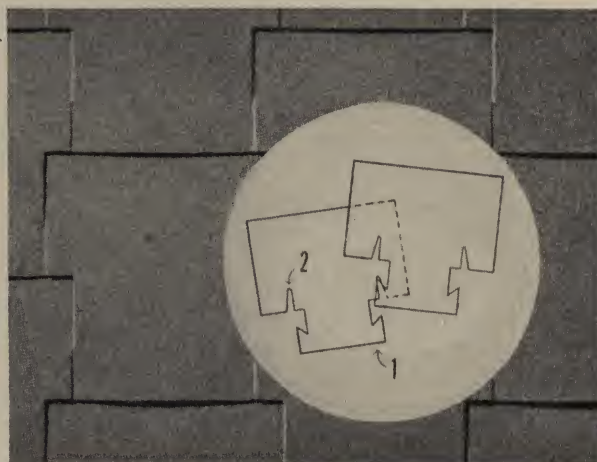
Johns-Manville Asphalt Shingles are applied in general accordance with the recommendations developed by the Engineering Committee of the Asphalt Roofing Industry Bureau of which J-M is a member. Complete application directions, including flashings and treatment of valleys, hips and ridges, appear elsewhere. The following details merely summarize the general details covering proper application.

**General:** The proper application of Asphalt Shingles is as important as the materials to assure satisfactory service. . . . Asphalt shingles can be used on roofs where the incline or pitch is not less than 4" to the foot. (The three-tab square butt strip shingles can be used on inclines of not less than 2" to the foot when applied over special underlayment.)

When used over wood sheathing, a layer of not lighter than No.15 Asphalt-Saturated Felt should be applied before application of shingles, with horizontal joints lapped 2" and vertical joints 4". . . . When applying asphalt shingles over old wood shingles, all decayed and missing shingles should be replaced and all loose and curved shingles securely nailed down to make the surface as smooth as possible. It may be necessary to smooth out the old roof deck by nailing on beveled wood strips with the thick edges against the butts of the wood shingles.



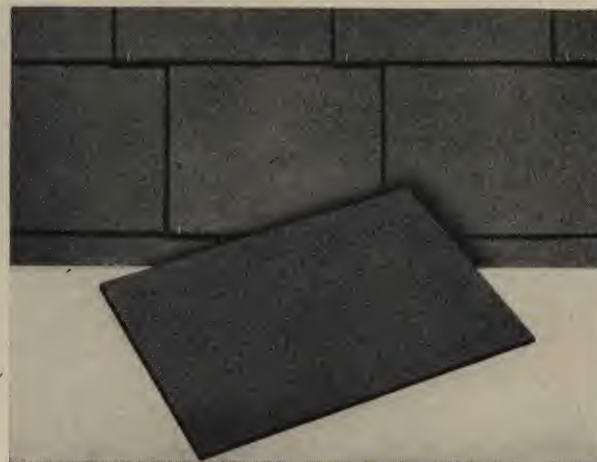
*J-M Giant Strip Asphalt Shingle*



*J-M Double-Coverage Weatherlok Asphalt Shingle*



*J-M Hexagonal (3-tab) Asphalt Shingle*

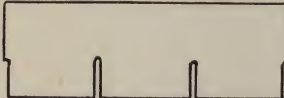


*J-M Giant Unit Asphalt Shingle (Dutch-Lap Method)*




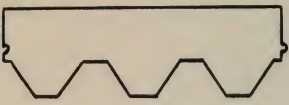
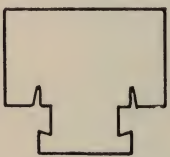
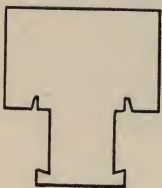
**J-M Asphalt Roofing Shingles**

[From Manville (M), N. J.; Waukegan (W), Ill.; Marrero (G), La.; and Fort Worth (E), Tex. Plants]

Shape	Catalog Number and Description	Colors	Plants	Unit	Approx. wt, lb
	<b>Seal-O-Matic Shingles</b> Length—36" Width—12" Exposure—5" Headlap—2" Tabs—3 Shingles per sq—80 Type Material—Thick butt shingles with continuous band of special asphalt adhesive on under side of butts. <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Red Blend Green Blend Slate Blend Blue Blend Silver Blend Bermuda Red Neptune Green	W	sq	210
	<b>Giant Strip Shingles</b> Length—36" Width—12" Exposure—5" Headlap—2" Tabs—3 Shingles per sq—80* Type Material—Giant <i>Underwriters' Label Class-C</i>  * For application with 4" exposure, 100 shingles per square are required. Weight—Approx. 313 lbs per sq	<b>Smooth Surface</b> Black Spruce Green Tile Red Green Blend Red Blend Blue Blend Blue Green Blend Slate Blend Varicolor Slateblend Brown Blend Silver Blend Fieldstone Gray Shadow Black White Blend Winter Blue Bermuda Red Neptune Green	MW MW MW MW MW M MW MW W MW M M M W W W	sq	250
	<b>12" Thick Butt Strip Shingles</b> Length—36" Width—12" Exposures—5" Headlap—2" Tabs—3 Shingles per sq—80* Type Material—Standard with thick butts <i>Underwriters' Label Class-C</i>  * For application with 4" exposure, 100 shingles per square are required. Weight—Approx. 263 lbs per sq	<b>Smooth Surface</b> Black Spruce Green Tile Red Red Blend Green Blend Slate Blend Varicolor Slateblend Blue Blend Blue Green Blend Brown Blend Silver Gray Silver Blend Brown Fieldstone Gray Mountain Blend Shadow Black Winter Blue Bermuda Red Neptune Green White Blend White  <b>Textured Surface</b> Black Spruce Green Green Blend Blue Blend Brown Blend Red Blend Varicolor Slateblend Silver Blend	MWGE MWGE MWGE MWGE MWGE MW MW MWGE M G M GE GE MWGE WGE MW GE M MWGE MWGE MWGE MW E WGE  GE WGE MW E MWGE W E M M W	sq	210




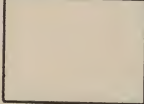



### J-M Asphalt Roofing Shingles

Shape	Catalog Number and Description	Colors	Plants	Unit	Approx. wt. lb.
	<b>11-1/3 Standard—2 Tab Hexagonal Shingles</b> Length—36" Width—11 $\frac{1}{3}$ " Exposure—4 $\frac{2}{3}$ " Headlap—2" Tabs—2 Shingles per sq—86 Type Material—Standard <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Tile Red Blue Blend Brown Blend Red Blend	GE GE GE GE E E	sq	167
	<b>11-1/3 Standard—3 Tab Hexagonal Shingles</b> Length—36" Width—11 $\frac{1}{3}$ " Exposure—4 $\frac{2}{3}$ " Headlap—2" Tabs—3 Shingles per sq—86 Type Material—Standard <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Tile Red Green Blend Red Blend Blue Blend  <b>Textured Surface</b> Spruce Green Green Blend Red Blend Blue Blend Brown Blend	M MW M W W MW  W	sq	167
	<b>Double Coverage Weatherlok Shingles</b> Size—20" x 18" Sidelap—4 $\frac{1}{4}$ " Headlap—6" Shingles per sq—120 Type Material—Heavyweight <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Red Blend Green Blend Blue Blend Varicolor Slateblend Brown Blend Silver Blend Silver Gray Brown Turquoise Blend Pecos Green Mountain Blend Indian Red Neptune Green Bermuda Red Canyon Pastel White	M MW MW MW MW MW W W E E E E E E MW M E E	sq	230
	<b>Standard Weatherlok Shingles</b> Size—20" x 23" Sidelap—4 $\frac{1}{4}$ " Headlap—3" Shingles per sq—72 Type Material—Heavyweight <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Red Blend Green Blend Blue Blend Varicolor Slateblend Tile Red Silver Gray Everglade Green Silver Blend Neptune Green	M MW MW MW MW MW G G G W MW	sq	170



**J-M Asphalt Roofing Shingles—Continued**

[From Manville (M), N. J.; Waukegan (W), Ill.; Marrero (G), La.; and Fort Worth (E), Tex. Plants]



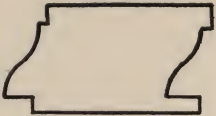
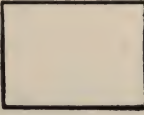
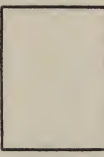
Shape	Catalog Number and Description	Colors	Plants	Unit	Approx. wt, lb
	<b>Giant Unit Shingles</b> (American Method) Length—16" Width—12" Exposure—5" Headlap—6" Shingles per sq—224 No Fasteners Supplied Type Material—Giant <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Blue Blend Spruce Green Tile Red Green Blend	M MW MW M W	sq	320
	<b>Giant Unit Shingles</b> (Dutch Lap Method) Length—16" Width—12" Headlap—2" Sidelap—3" Shingles per sq—112 Exposed corner fastened with copper or copperclad staples furnished with shingles if ordered. Copperclad clips also available from Waukegan. Type Material—Giant <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Blue Blend Spruce Green Tile Red Green Blend Silver Gray Mountain Blend <b>Textured Surface</b> Navajo Red Blend Green Blend Silver Blend	M MW MW M W E E E E E	sq	160
	<b>Giant Metalok Shingles</b> Size—16" x 16" Exposure—13½" x 13½" Lap—2½" Shingles per sq—82 Type Material—Giant Furnished with copper or copperclad staples <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Silver Gray Navajo Red Blend Saddle Browntone Gulf Blue-Green Multi-Slate Blend Palmetto Green	E	sq	162
	<b>Standard Metalok Shingles</b> Size—16" x 16" Exposure—13½" x 13½" Lap—2½" Shingles per sq—82 Type Material—Standard Furnished with copper or copperclad staples <i>Underwriters' Label Class-C</i>	<b>Smooth Surface</b> Black Spruce Green Tile Red Ocean Blueblend Silver Gray Multicolor Slateblend Palmetto Green	G	sq	135
	<b>Hip &amp; Ridge Shingles</b> Size—9" x 12¾" Shingles per sq—378 Type Material—Standard For Hips & Ridge only <i>Underwriters' Label Class-C</i> When applied with 5" exposure one square covers 157½ lin ft of hips and ridges One bundle covers 52½ lin ft	<b>Smooth Surface</b> (Appropriate matching colors)	MWGE	sq	253







## J-M Asphalt Shingles Available from Pittsburg and Los Angeles Plants


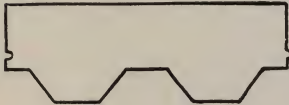

Shape	Names and colors	Size, in.	Exposure, in.	Head lap, in.	Shingles per sq.	Approx. wt. lb., per sq.
	<b>12" Thick Butt Strip Shingles</b> Sunset red      Black Spruce green      Silver gray Green blend      Blue blend Brown blend      Silver gray blend	36x12	5	2	80	210
	<b>11 1/3" Standard Hexagonal Shingles</b> Black      Spruce green Sunset red      Silver gray	36x11 1/3	4 2/3	2	86	167
	<b>Latch Thatch Shingles</b> Sunset Red      Spruce green Black      Silver gray	18x12	8 1/4	3 3/4	116	150
	<b>Dutch Lap Shingles*</b> Spruce green      Sunset red Black      Silver gray	16x12	13x10	2	112	130
	<b>Hip and Ridge Shingles</b> Spruce green      Sunset red Black      Silver gray Green blend      Blue blend Brown blend      Silver gray blend	12 3/4 x 9	4	8 3/4	378	252

\* Dutch Lap Shingles (Pittsburg only).

PRODUCT INFORMATION IS SUBJECT TO FREQUENT CHANGE. THE EXACT DETAILS AND AVAILABILITY AT PARTICULAR LOCATIONS SHOULD BE CHECKED WITH THE NEAREST JOHNS-MANVILLE OFFICE.



**J-M Asphalt Shingles Available from Asbestos Plant**

Shape	Names and colors	Size, in.	Exposure, in.	Head lap, in.	Shingles per sq.	Approx. wt. lb., per sq.
	<b>Flexstone Thick-Butt Shingles</b> Standard blue-black   Killarney green Tile red   Montrose red Standard green   Autumn brown Spruce green   Heather blue Imperial blue	36x12	5	2	80	210
	<b>Slatekote Thick-Butt Shingles</b> Standard blue-black   Killarney green Tile red   Montrose red Standard green   Autumn brown Spruce green   Heather blue Imperial blue	36x12	5	2	80	210
	<b>Flexstone Hexagonal Shingles</b> Tile red   Montrose red Standard green   Killarney green Spruce green   Standard blue-black	36x11½	4¾	2	86	165
	<b>Slatekote Hexagonal Shingles</b> Tile red   Montrose red Standard green   Killarney green Spruce green	36x11½	4¾	2	86	165
	<b>Slatekote Locnotch Individual Shingles</b> Standard green   Tile red Standard blue-black   Killarney green Spruce green	16x16	14x14	2	80	125



*For farm buildings, J-M Asphalt Shingles provide economical weather protection, fire resistance and attractive appearance*







SOUND CONTROL



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## Sound Control

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## J-M Systems of Sound Control



*J-M Systems of Sound Control provide the means for overcoming a great variety of sound problems. The acoustical treatment and sound isolation used in this broadcasting studio assure brilliance to the studio and fidelity to the program*

The control of sound is every day becoming increasingly imperative to human health, comfort and efficiency. Wherever groups of people gather indoors for entertainment, worship or education, the problem of room acoustics or hearing conditions nearly always arises. In places where people work, study or eat, the need for sound-quieting is urgent. This is even more true in hospitals and sanitariums. The problem in other places, such as in machinery rooms, becomes one of sound isolation, the control of sound transmission and vibration.

For many years, Johns-Manville has pioneered in the solution of these sound control problems. The practical applications of control principles are predicated upon the researches of Professor Wallace C. Sabine of Harvard, who reduced the subject of sound as it relates to building interiors to an exact science. Retained by Johns-Manville as acoustical consultant, Professor Sabine carried forward his studies in collaboration with the J-M Research Laboratories, which still continue his work. As a result of these studies many techniques and materials have been developed; these serve as a basis for the J-M Systems of Sound Control through which thousands of acoustical difficulties have been overcome.

### The Engineering Problem

Upon the researches of Professor Sabine are based the science of constructive and corrective acoustics, as applied to auditoriums and public buildings, and the noise reduction principles used in quieting offices, factories and hospitals. Professor Sabine discovered that poor hearing conditions result from reverberation, the persistence of sound after its source has ceased. This phenomenon is caused by excessive sound reflections from the walls and ceiling. These reverberations prevent the listener from distinguishing successive words or sounds as definite and separate elements. The result, to the listener, is irritation, confusion and consequent lack of intelligibility. Excessive sound reflections are also responsible for much of the din which prevails in offices, factories and other places where machinery is used. Professor Sabine concluded that through the use of certain materials the sound waves could be satisfactorily absorbed and excessive reflections eliminated.

He proceeded to work out a method of calculating the duration of reverberation under various conditions. This, he expressed in the formula,  $T = \frac{.05 V}{a S}$  wherein  $T$  equals the reverberation time in seconds;  $V$





*In addition to quieting the disturbing noise, the Sanacoustic ceiling in the Toronto office of Colgate-Palmolive-Peet Co., Ltd., also affords the maximum of light reflection*

represents the volume of the interior in cu ft;  $a$  is the average coefficient of all reflecting surfaces, allowing for the relative area of each type of surface; and  $S$ , the total surface. The product of  $a \times S$  gives the number of absorption units in the room. An absorption unit is theoretically based upon the area of an open window one foot square from which, of course, no sound would be reflected. By comparison with this unit, the efficiency of all acoustical and sound-absorbing materials is measured.

A study was then made of rooms considered acoustically acceptable by average audiences. This revealed a direct relationship between the volume of the room and the number of absorption units necessary to reduce reverberation to an optimum time. From these data, were plotted curves which enable the competent acoustical engineer to calculate, in advance of construction, the acoustical or hearing qualities of an auditorium. In a similar manner existing buildings may be accurately analyzed.

Further studies have developed methods to measure noise that results from necessary machine operations. In addition, a technique for isolating sound at its point of origin has been devised. As a result of this broad background of research, Johns-Manville has corrected many thousands of installations requiring the control of sound.

### *Practical Application:*

The first general division of sound control embraces the improvement of audition in theatres, auditoriums and churches. It deals with the elimination of echoes, excessive reverberation and extraneous

noises. With proper acoustical treatment, the audience may enjoy the entertainment or hear the speaker with ease. The treatment is effected with sound-absorbing materials applied to the reflecting surfaces.

Sound-absorbing treatments for the reduction of noise-level constitute the second general division. These treatments are applied in offices, banks, schools, hospitals and, in fact, wherever objectionable noise is produced. Through the use of such treatments, protection is afforded against discomfort, distraction and irritation from excessive noise. These first two groups are sometimes classified together as acoustics for room interiors.

Sound isolation, the third general division, involves the prevention of sounds and vibrations generated in one place from reaching another through interposing partitions, ceilings or floors. It includes the treatment of such locations as bowling alleys and broadcasting studios as well as machinery rooms. The underlying principles of sound isolation are entirely different from those employed to correct interiors for air-borne sound. However, in many cases both types of treatment are necessary as in broadcasting studios.

The control of machine noise makes up a fourth general group. This division often proves to be complex and quite different from those which involve the ordinary problems of room acoustics or vibration control. The most effective way to avoid noise generation in mechanical equipment is through careful designing, manufacturing and testing. Remaining noises can usually be controlled by proper treatment.

In all the other divisions of sound control, as in equipment-quieting, the proper planning and choice of materials, prior to building, permits considerable economy. However, it is usually feasible to apply corrective measures after erection of the structure.

### **Selection of Materials**

In choosing a sound control material, the factors of chief importance are the efficiency of the material to absorb sound in the frequencies encountered, low maintenance cost and fire resistance. Where an acoustical installation acts as a surface of the room interior, other primary considerations include ease of cleaning, paintability, light reflection coefficient and decorative qualities of the material.

An analysis of any sound control problem can be obtained by writing to the nearest Johns-Manville office. Without obligation, a J-M engineer will study the conditions and suggest a suitable treatment.



## Description of Materials



*Sanacoustic Units on this fluorescent-lighted ceiling are both attractive and acoustically efficient*

The following J-M sound control materials are adaptable to every type of acoustical problem. For sizes, thicknesses, etc., see table on the reverse of this sheet.

Sanacoustic® Units, because of their high degree of sound absorption, low maintenance cost and permanence, are widely recognized as the ideal acoustical material. Made up of metal and mineral wool, the unit will not burn, rot or disintegrate.

A Sanacoustic Unit consists of a perforated and enameled sheet-metal casing, which contains a mineral wool pad—the sound-absorbing medium. The pad is completely wrapped with flame-proofed paper. The units lock into tee bars, which are mechanically fastened to the surface to be treated. This method of erection enables a Sanacoustic installation to be taken down and re-located without loss of materials.

The enamel that is baked on the perforated metal facing is tough and durable and it may be washed repeatedly without injuring the finish. Sanacoustic Units also may be painted without loss of sound-absorbing efficiency, although this is unnecessary unless a change of color is desired. The permanence of the enameled-metal surface and the ease with which it may be cleaned assure low maintenance costs.

Sanacoustic Units are available in standard white enamel. Unperforated units for borders or pattern work

are obtainable in the same size as the perforated units.

Sanacoustic Ventilating Ceiling, besides quieting room noise, also affords uniform distribution of air. It consists of a suspended ceiling of Sanacoustic Units so installed that the furred space becomes a plenum chamber for the air-conditioning system. The thousands of perforations in each Sanacoustic Unit serve as supply openings, through which air flows slowly and noiselessly into the room.

A slight air-pressure is built up in the plenum chamber behind the Sanacoustic Ventilating Ceiling and air is carried past the sound-absorbing pad to the perforated metal surface through Air-Flow Channels.

Sanacoustic Units with Fluorescent Lighting is another distinctive ceiling treatment offered by Johns-Manville. Sanacoustic Units are efficient, easy-to-clean sound-absorbents. Fluorescent lighting gives more light and radiates less heat on the same wattage required for other systems. The combination of Sanacoustic Units and fluorescent lighting provides a practical, economical, highly efficient and attractive ceiling.

When the lighting and acoustical requirements have been determined, tee bars are secured to the surface to be treated. Troffers, flanged to fit the tee bars, are located and the fluorescent tubes are installed. The ceiling is then completed with Sanacoustic Units. This sus-



pendent type ceiling can be removed and re-located without loss of materials.

**Fibretone®** is an insulating-board type of material designed for noise-quieting where requirements of economical construction must be met. Fibreton is made with circular perforations extending into the sound-absorbing material. The units are supplied in white with beveled edges. Border units without perforations are also available. The 12" x 24" size is also furnished with a V groove to simulate two 12" x 12" units.

The material can be painted and repainted without loss of sound-absorbing efficiency.

**Permacoustic® Units**, made of mineral wool and a suitable binder in monolithic construction, combine attractive appearance and a non-combustible fire rating. The fissured or textured surface is considered architecturally desirable. The units are particularly effective

for such locations as conference rooms, executive offices, etc. They are made with either squared or beveled edges. The units are also available with kerfed edges for splines. Permacoustic is furnished in white.

**Transite® Acoustical Panels** consist of large sheets of perforated Transite  $\frac{3}{16}$ " thick, which are installed with a backing of mineral wool sound-absorbing elements. The panels are available in natural gray with beveled or square edges and in standard white finish with beveled edges only.

The appearance of an unbroken perforated area can be had by ordering unbeveled Transite Acoustical Panels  $23\frac{7}{8}$ " x  $23\frac{7}{8}$ " and  $23\frac{7}{8}$ " x  $47\frac{3}{4}$ ".

**Airacoustic®** is a particularly effective, sound-absorbing material for use in ventilating ducts. It is composed of mineral wool and a suitable binder.

### Description of Materials—Summary

Size, Inches	Thickness, Inches	Color	Application
Sanacoustic Units			
12 x 24	2½ (Including Furring)	White	Mechanical Fastening
Fibretone Units			
12 x 12*	½ ½ ¾ } ** ¾ ¾ 1	White	Cement or Mechanical Fastening
12 x 24			
12 x 12*			
12 x 24			
24 x 24			
12 x 12*			
Transite Acoustical Panels			
23⅞ x 23⅞*** 24 x 24 23⅞ x 47¾*** 24 x 48	⅜ Plus Furring	Natural Gray or White (Prime Coat)	Mechanical Fastening
Permacoustic Units			
12 x 12 12 x 24	¾ and ⅞ ¾ and ⅞	White	Cement or Mechanical Fastening
Airacoustic Sheets			
24 x 36	½, 1 and 1½	—	Cement or Mechanical Fastening

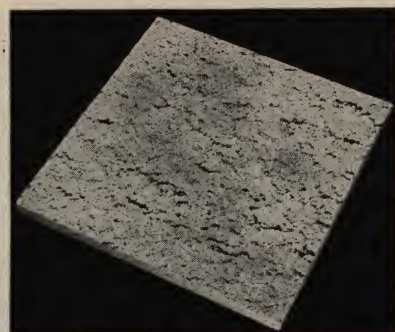
\* Variety drilled. \*\* Also furnished kerfed and cut back four sides.

\*\*\* Furnished square edge only to give uniform spacing of holes over entire area.





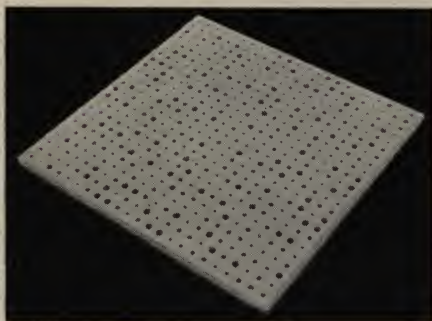
Sanacoustic Unit Type "S" at left, Type "L" at right



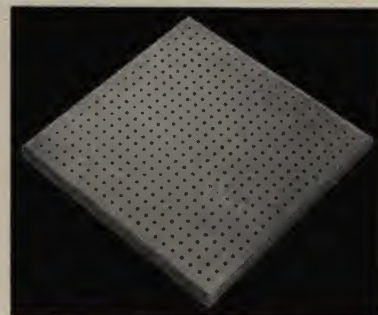
Permacoustic Unit—Fissured Surface



Fibre-tone Border Unit—Plain



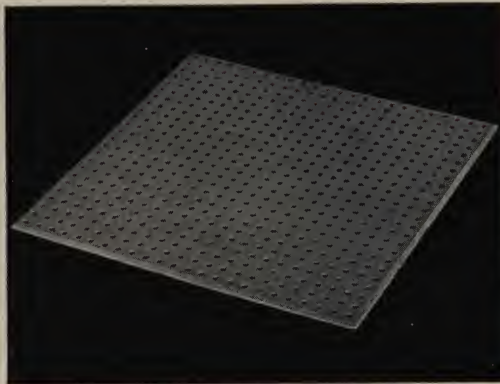
*Left*  
Fibre-tone Unit with  
Variety Drilling



*Right*  
Fibre-tone Unit with  
Standard Drilling



Studio Element



Transite Acoustical Panel



Sound Isolation Blanket

*The Transite Acoustical Panel is used over the rigid Studio Element or Sound Isolation Blanket to achieve the correct acoustical balance*



## Additional Acoustical Materials and Accessories

Following are descriptions of additional J-M sound control materials used for a wide variety of conditions and locations. Also included are accessories for the installation of treatments.

**Acoustical Cement, No.132:** Used for spot-cementing rigid acoustical units. One gallon covers 40 to 65 sq ft of units depending upon condition of ceiling and method of application.

**Air-Flow Channels:** Passageways governing the amount of air transmitted from the plenum chamber of the Sanacoustic Ventilating Ceiling into the room. Available 24" long with ten, six, three, or one openings.

**Akoustikos Felt, No.400:** Made of Asbestos fiber and selected hair, is used where a flexible sound-absorbent is necessary. Supplied in 180 sq ft rolls (3 ft x 60 ft) and thicknesses of  $\frac{1}{4}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1". Special cut pieces available on application.

**Banacoustic Blankets:** Fire-resistant acoustical blankets made from mineral wool, felted and held between various types of wire mesh. The material is covered with plain muslin or with flame-proofed muslin on one side between mineral wool and wire mesh and also around the edges. The blankets are often placed behind ornamental grilles. They are also utilized to quiet mechanical equipment. Supplied in types shown in the following table; in thicknesses of 1", 1 $\frac{1}{2}$ " and 2"; and sizes of 24" x 48" and 24" x 96", unless otherwise specified.

*Standard Types of Banacoustic Blankets*

Style No.	Type of Cover
102	1" wire mesh both sides
103	Stucco lath both sides
112	1" wire mesh and metal lath
113	1" wire mesh and stucco lath

**Broadcasting, Television and Recording Studio Treatment:** The treatment utilizes Studio Element, 2" thick, covered with decorated sheets of perforated Transite applied to walls and ceilings. Sound Isolation Blankets, 1" and 2" thick, are sometimes used. Low-frequency Element and Triple-Tuned Element are available on special order for use in studios behind Transite Acoustical Panels.

**Sound Isolation Blankets, Types MK, MM, and KK:** Composed of 1" and 2" mineral wool, stitched between sheets of various materials. Type MK has flame-proofed kraft paper one side and flame-proofed muslin the other; Type MM, flame-proofed muslin both sides; Type KK, kraft paper both sides.



*Sanacoustic Units with fluorescent lighting*

Types MK and MM are furnished in 22" and 36"-wide rolls; Type KK, 36" wide only. Lengths are 50 ft for 1" thicknesses and 25 ft for 2" thicknesses. Edges are unsealed.

**Studio Element:** A rigid, lightweight, sound-absorbing product made of mineral wool which is formed with an inorganic binder. The sheets are supplied 1" and 2" thick, 22" x 36'.

**Spinacoustic:** A semi-rigid lightweight, non-combustible, sound absorbent made of mineral wool. It has a density of five pounds per cubic foot and can be cut easily with a knife. Spinacoustic is high in acoustical efficiency. It is supplied in lengths of 30" and 60" and widths of 22", 24" and 30". Thicknesses are 1", 2", and 3".

Occasionally, materials that were designed primarily for the quieting of mechanical equipment can be advantageously adapted to acoustically treat room interiors. Descriptions of these J-M products may be found on a separate data sheet under the heading Sound Control of Mechanical Equipment.



## Sound Absorption and Light Reflection

The data given below is based upon tests conducted by the Acoustical Materials Association. Reference

notes and information, concerning the actual test figures tabulated, are included after the chart.

Type of Material	Thickness, inches	Mounting Number	Coefficient Frequencies						Noise Red. Coef.	Light Reflection		Flame Resistance	Wt per Sq Ft, lb	Surface of Material	A.M.A. Test Number
			125	250	500	1000	2000	4000		Color	Value				
<b>Sanacoustic*</b>													(Pads)		
Type KK Pad	2½	3	.29	.68	.99	.99	.89	.52	.90	W	.77	A	.75	Note 1	A53-136
Type KK Pad	2½	3	.38	.60	.66	.72	.53	.46	.65	Wp Wu	.77 .85	A	1.17	Note 2	A52-355
Spincooustic Pad	2½	3	.27	.59	.99	.99	.80	.65	.85	Wp	.77	A	.95	Note 1	A54-218
<b>Transite Acoustical Panels</b> (Plus Mineral Wool Blanket)	1¾ 2¾	5 8	.07 .22	.32 .79	.89 .99	.99 .97	.75 .79	.55 .54	.75 .90	W W	.73 .73	A A	.45 .70	Note 3 Note 3	AS55-51 AS55-52
<b>Spincooustic</b>	1 2	4 4	.06 .47	.36 .88	.81 .99	.91 .99	.88 .94	.78 .87	.75 .95	— —	— —	— —	.36 .73	Un- painted)	A55-102 A55-103
<b>Fibre-tone</b> (Standard Drilled)	½ ½ ¾ ¾ 1 1	1 2 1 2 1 2	.03 .19 .10 .18 .23 .30	.21 .55 .32 .63 .39 .65	.62 .50 .81 .67 .87 .76	.68 .65 .90 .88 .95 .94	.72 .71 .79 .78 .79 .86	.68 .71 .67 .77 .68 .73	.55 .60 .70 .75 .75 .80	W W W W W W	.77 .77 .77 .77 .77 .77	C,D C,D C,D C,D C,D C,D	.66 .66 .97 .97 1.24 1.24	Note 4&6 Note 4&6 Note 5&6 Note 5&6 Note 6&8 Note 6&8	A54-26 A54-25 A54-28 A54-27 A54-30 A54-29
<b>Fibre-tone</b> (Variety Drilled)	½ ½ ¾ ¾	1 2 1 2	.06 .10 .10 .18	.15 .54 .29 .66	.62 .53 .73 .60	.70 .64 .81 .76	.70 .73 .73 .76	.71 .71 .75 .75	.55 .60 .65 .70	W W W W	— — — —	— — — —	.65 .65 .98 .98	Note 7 Note 7 Note 7 Note 7	A54-66 A54-65 A54-68 A54-67
<b>Permacoustic</b>	¾ ¾ ¾ ¾	1 7 1 7	.18 .56 .13 .64	.35 .64 .43 .55	.83 .77 .80 .57	.86 .92 .83 .79	.82 .99 .76 .83	.77 .89 .68 .74	.70 .85 .70 .70	W W W W	.78 .78 .78 .78	A A A A	1.32 1.32 1.60 1.60	(Fissured Painted White)	A55-88 A55-87 A53-52 A53-51
<b>Airacoustic</b>	½ 1	6 6	.11 .17	.42 .49	.43 .76	.77 .89	.84 .94	.82 .85	.60 .75	— —	— —	A A	.64 1.21	Unpainted Unpainted	A52-165 A52-166

\* Total thickness includes Sanacoustic pan plus pad, pad supports and furring.

### Types of Mountings

1. Cemented to plaster board with ½" air space. Considered equivalent to cementing to plaster or concrete ceiling.
2. Nailed to 1" x 3" wood furring 12" c to c unless otherwise indicated.
3. Attached to metal supports applied to 1" x 3" wood furring.
4. Laid directly upon laboratory floor.
5. Furred 1", furring 24 c to c, 1" mineral wool between furring.
6. Attached to 24-gage sheet iron, supported by metal angles.
7. Mechanically mounted on special metal supports.
8. Furred 2", furring 24 c to c, 2" mineral wool between furring.

### Noise Reduction Coefficient

The noise reduction coefficient is the average of the coefficients at frequencies from 250 to 2000 cycles inclusive to the nearest five percent. This average coefficient is recommended in comparing noise-quieting materials. For auditorium treatment, long usage has established the practice of computing reverberation times at the single frequency of 500 cycles. However, consideration should be given to the absorption coefficients at other frequencies.

### Color

The letter designations given in this column are as follows: W=White; Wp and Wu=White perforated and unperforated, respectively, where surface is a combination of perforated and unperforated units.

### Flame Resistance

The ratings given here are in accordance with Federal Specification terminology: A=Incombustible; B=Fire Retardent; C=Slow Burning; and D=Combustible.

### Surface

Note 1: Perforated enameled metal pan backed with KK mineral wool pad: 0.075" diameter perforations, 4608 per sq. ft. . . . Backed with Spincooustic pad: 0.10" diameter perforations, 1625 per sq ft.

Note 2: 50/50 pattern; one-half perforated enameled metal backed with mineral wool pads; one-half enameled metal unperforated and unbacked. Perforations are 0.10" in diameter, 1625 per sq ft.

Note 3: Painted. Perforations are ⅜" diam, 600 per sq ft.

Note 4: Painted. Holes are ⅜" in diameter, ⅜" deep, 484 per sq ft.

Note 5: Painted. Holes are ⅜" in diameter, ⅝" deep, 484 per sq ft.

Note 6: When finished with flame-resistant paint, the rating is "C" (slow burning) and the light reflection is 0.80.

Note 7: Painted. There are 529 variety-drilled holes per sq ft—221 of ⅜" diam; 199 of ⅜"; and 109 of ¼". Each hole is 1⅜" deep.

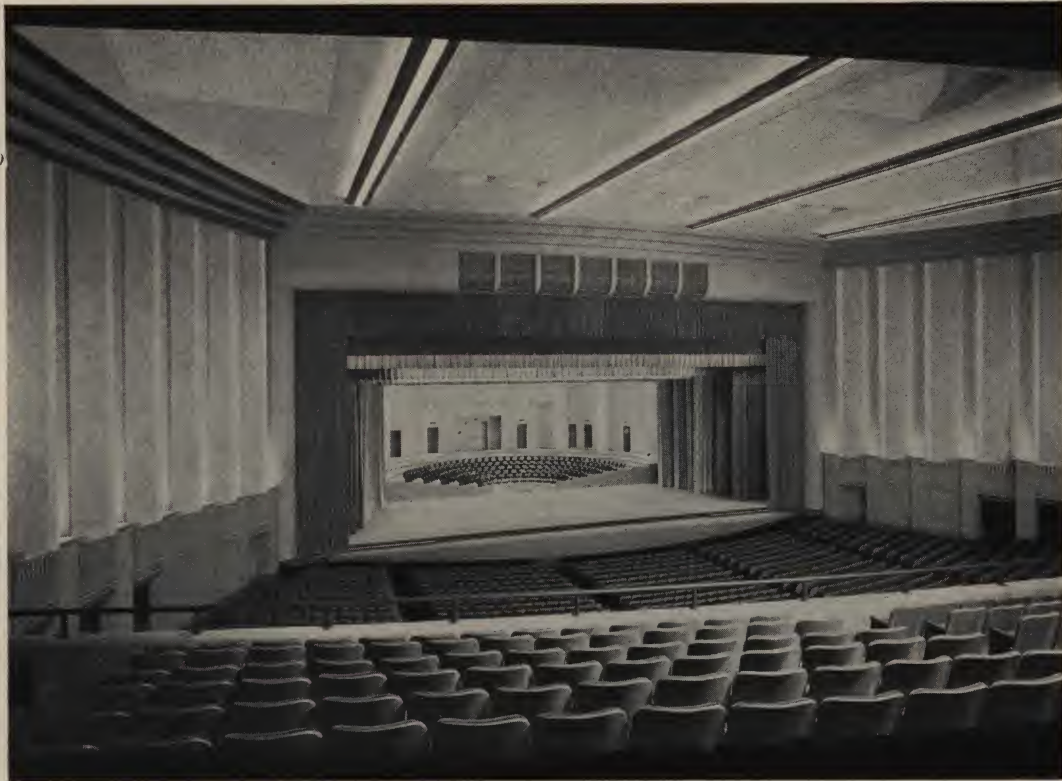
Note 8: Painted. Holes ⅜" diam, ⅝" deep, 484 per sq ft.







## Architectural Acoustics



*Music, lectures, sound pictures—any type of program—will be heard to advantage in this university auditorium. J-M acoustical materials on the walls and ceilings, besides harmonizing with the decorative scheme, assure proper acoustical conditions throughout the auditorium*

Speech and music place very exacting acoustical requirements upon assembly halls, churches and theatres. The spoken syllables and words must be distinctly separate to assure intelligibility and ease of hearing. On the other hand, a certain amount of tone blending is desirable in music. If an auditorium is used for both purposes, the most satisfactory acoustical balance must be struck.

The Sabine formula is the standard method employed by acoustical engineers to solve the sound problems of auditoriums. In broadcasting studios, the modified formula for "dead rooms" should be used. In either case, to solve the problem correctly and economically, careful consideration must be given to the specific size of the room, the kinds of presentations for which it will be used, the types of furnishings and the audience normally present. The audience, in particular, is an important factor of sound absorption. Frequently, a room that is satisfactory with a capacity audience is unsatisfactory when only partially filled. In such cases, it is neces-

sary to introduce sufficient absorption materials to offset the lack of audience, an adjustment that will insure comfortable hearing.

### Auditorium Acoustics

In auditoriums, the size and shape of the room are of paramount importance. The rectangular room is most desirable from an acoustical standpoint. Since curved surfaces tend to focus sound, echoes and dead spots result. The installation of a corrective treatment to the troublesome curve minimizes the sound focus and reduces the echo. However, the effect is more readily accomplished by a careful analysis before construction, calculated to adjust the radius of curvature of the surface or possibly to eliminate the curved surface entirely.

Favorable factors for good hearing include proscenium openings with large splayed surfaces to add reinforcement to the sound and wide balcony openings to allow the entry of sufficient sound to reach the rear seats. If better hearing conditions and the





*This auditorium of a large insurance company is treated with J-M acoustical materials*

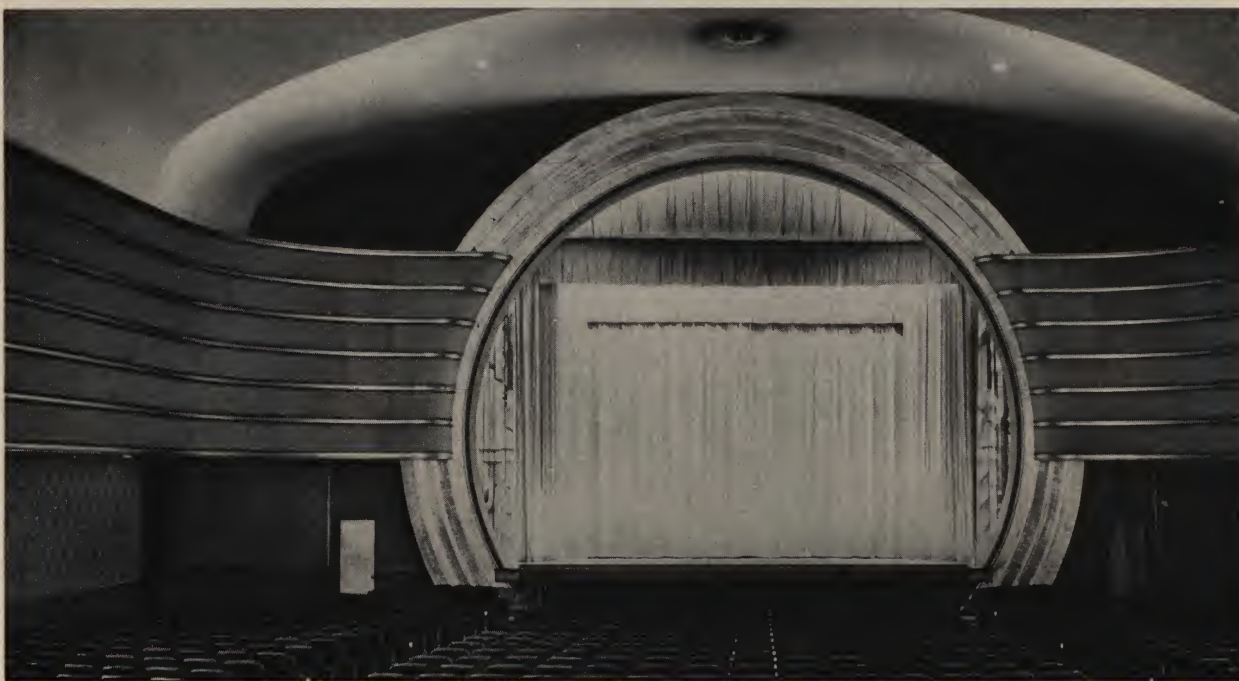
undivided attention of the audience are to be insured, the elimination of extraneous noises is necessary.

The introduction of sound amplification has increased the need for acoustical materials. It has been found that amplification usually increases the intensity of the reverberation or reflected sound as well as the original sound. The increased reverberation can be offset only by absorption. Consequently, sound theatres and auditoriums with public address systems

require more sound-absorbing treatment than correspondingly large auditoriums without amplification.

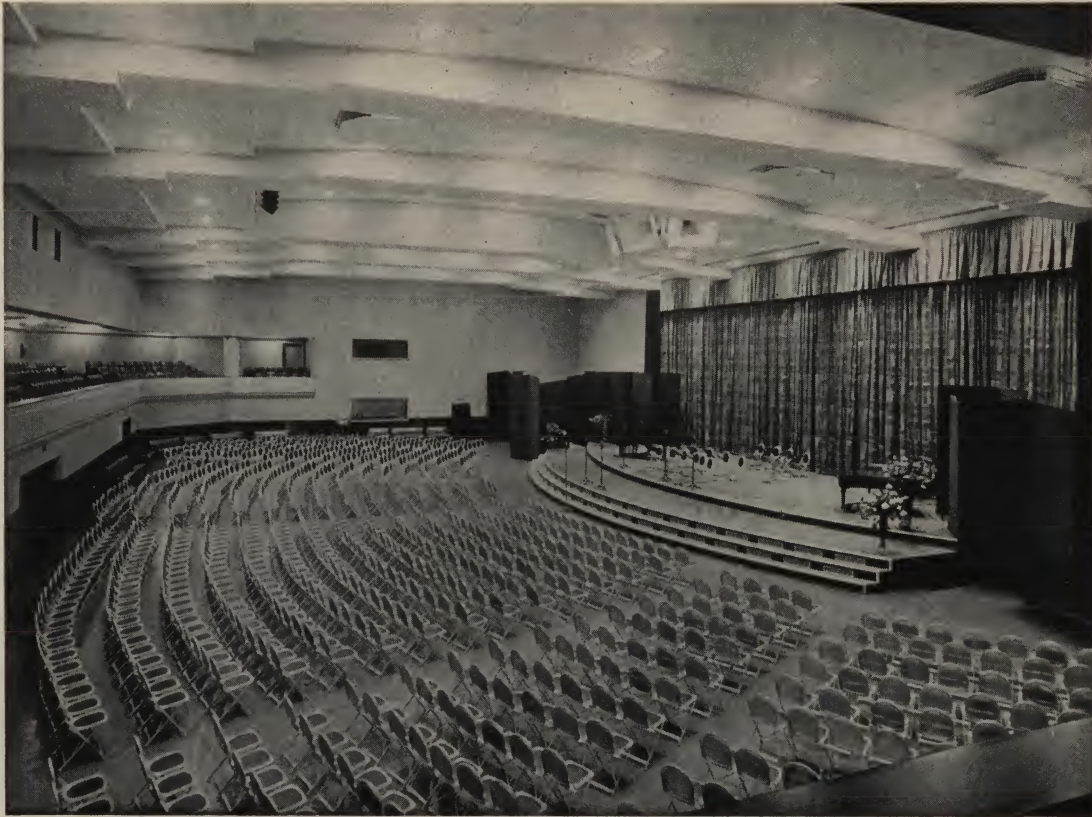
Ordinarily, acoustical materials are installed on large unbroken surfaces since such areas usually cause most of the hearing difficulties in auditoriums. The distance of these surfaces from the stage is an important consideration in determining the treatment because the reflection of sound from greater distances is more likely to cause echoes. When the auditorium has a low ceiling, treatment is usually confined to the rear and side walls. When high, the ceilings also are treated in many instances. Due to the directional power of amplification systems, rear wall treatments are of prime importance for theatres. Concave surfaces should always be treated when the center of curvature falls near the audience or source of sound.

Great care must be exercised in analyzing auditoriums. Acoustical materials must be selected for appearance and for efficiency. Normally, acoustical efficiency in auditoriums is calculated at 512 cycles per second. The efficiency and easy maintenance of Sana-coustic; the practicability of Fibretone; the ruggedness of Transite Acoustical Panels in service conditions involving moisture or impacts; the economy of Fibra-coustic and the many possibilities of Nashkote finishes permit the correction of every phase of auditorium acoustics with architectural authenticity.



*The variety and flexibility of J-M acoustical materials make possible the fulfillment of all architectural requirements. The acoustical treatment in this theater interior consists of Transite Acoustical Panels in the horizontal bands and decorative Nashkote treatment between the wainscot and the first band*





*The world's largest broadcasting studio, located in Radio City, New York, is treated with Transite Acoustical Panels and is completely divorced from the building structure with the J-M System of Sound Isolation (Photograph, courtesy of the National Broadcasting Co.)*

### Studio Acoustics

In broadcasting, recording and sound picture studios, the problem of acoustical control is a difficult one. Reverberation must be reduced at all frequencies. Otherwise, intensified fundamentals or harmonics and the impression of an unbalanced orchestra will result. Good absorption of the lower frequencies is necessary to prevent a predominance of the bass, the so-called booming effects. Yet, a certain amount of high frequency reverberation is desirable to give brilliance to the studio and fidelity to the program.

Authorities, in general, agree that the average period of reverberation for broadcasting studios should range between 0.5 and 1.0 second, according to the volume. The modified reverberation formula,  $T = \frac{.05 V}{-S \log_e (1-a)}$ , is used for application to rooms with a high ratio of absorption to volume (dead rooms). In this formula  $T$  equals the reverberation time in seconds;  $V$ , the volume of the interior in cu ft;  $S$ , the total surface; and  $a$ , the average coefficient of all reflecting surfaces, taking into account the relative area of each type.

During the past twenty years, Johns-Manville engineers have studied and recorded reverberation characteristics of such rooms. They have designed and constructed studios, and have investigated their satisfactory operation in actual practice. As a result of these observations and studies, Johns-Manville recommends the correction of studios for an average reverberation over six frequencies, namely 128, 256, 512, 1024, 2048 and 4096 cycles.

To meet such a condition, the acoustical material used must have sound absorbing efficiency over the entire range from 128 to 4096 cycles, and a frequency characteristic that approximates the complement of the equal loudness contours.

The desired correction may be obtained with J-M Broadcasting Studio Treatment, a construction which consists of a rigid Studio Element, finished with decorated sheets of perforated Transite. In addition, various thicknesses of mineral wool blankets, which are covered with a perforated metal or Transite facing, are frequently used to obtain special acoustical results.





*Modern bank with J-M acoustical products on the walls and ceiling*



*Typical modern office sound-controlled with a ceiling of Sanacoustic Units*



## Noise Quieting



*Sanacoustic has brought relief from distracting noise to hundreds of busy workers of this large general office of the Prudential Life Insurance Company, Newark, N. J.*

Noise reduction, as applied to offices, banks, schools, hospitals, restaurants and factories, does not involve the preservation of the character of sound as produced. Rather, it deals with the absorption of unwanted noise. The deleterious effects of such noise upon the human individual and the importance of control over its disturbing influence has received much attention.

Careful research has revealed that if noise energy is absorbed as rapidly as it is produced, preventing its reinforcement and accumulation, the nerve-wracking intensity of noise can be eliminated. The installation of sound-absorbing materials on the ceilings or walls of room interiors has proved to be the solution to the problem with regard to air-borne sound. Transmitted noise requires additional treatment.

Johns-Manville's acoustical engineers are equipped to investigate noise problems and recommend the appropriate treatment to rectify the condition. With the use of electrical noise-measuring instruments and after consideration of the size and furnishings of the room, they can make definite recommendations and predict what the treatment will do. After the installation, the prediction is verified by means of the noise meter which registers the loudness of sound.

The unit most commonly used for denoting the loudness of a sound is the "decibel," abbreviated "db." The loudness of a given sound expressed in decibels is ten times the common logarithm of the quotient obtained by dividing the intensity of the given sound by the intensity of a barely audible sound of the same pitch. One decibel corresponds roughly to the slightest change in loudness that can be distinguished by the human ear.

### NOISE CONTROL BY ABSORPTION

March, 1947 (Cancelling sheet dated February, 1938)

BMS-20





*The J-M Sanacoustic ceiling in Childs Restaurant, Peel Street, Montreal, P. Q., contributes to the pleasant, quiet atmosphere so conducive to enjoyable dining*

### Hospitals and Sanitariums

In hospitals and sanitariums the difficulty results mainly from noises originating in diet kitchens, corridors, etc. Relative to the need for quieting treatment in such locations, Dr. L. F. Barker, of Johns Hopkins, made the following statement:

"When one goes to sleep it is much easier to cut off the sensory stimuli which arrive through the eye than those which arrive through the ear. We can put out the light and we can close our eyes, but there is no satisfactory way of closing our ears to extreme stimulation, and noises in the street, building or house,

act on the brain and prevent sleep. When the body is strong and healthy, it is possible, as a rule, to grow accustomed to go to sleep and continue sleeping despite considerable noise. Most of us who live in cities learn this, but nervous people who are very delicately organized are often super-sensitive to sound. Almost all sick persons are in a state of pathological fatigue and loud, disagreeable noises increase this fatigue to a danger point."

Sanacoustic Units closely meet all the requirements for silence in hospitals. In addition it meets the essential need for sanitation as set forth by Mr. C. F. Neergaard, noted hospital consultant, before Sanacoustic even existed. He recommended that a sound-absorbing material "be an inorganic, highly porous tile, smooth finished, even glazed perhaps, and tinted, never needing to be painted, and everlastingly washable."



*Quiet, so important in hospitals, is made possible with Sanacoustic. Allegheny Hospital, Pittsburgh, Pa.*

### Restaurants and Cafeterias

Comfort in restaurants and cafeterias is largely dependent upon quiet surroundings. The din usually incidental to the serving of food must be eliminated if comfort is to be assured. It has been proved that quieting treatments of Sanacoustic and other J-M sound-absorbing materials have paid excellent dividends by making dining hours more restful. When the kitchen is adjacent to the dining room, the clatter of dish-washing and serving usually necessitates the treatment of the kitchen as well.

Acoustical treatment also provides a solution to the problem that arises when luncheons and banquets are followed by speeches.



### Schools and Colleges

Noises from the corridors, typewriter rooms, music rooms, gymnasiums and classrooms constitute the major sound control problem in schools. The noises are usually carried from the point of origin through the reverberant corridors into the adjacent classrooms or study halls, causing interference with instruction and distraction from studies.

The disturbing influence of noise hinders the students' efforts to concentrate. It also tends to cause nervousness in the instructors because of their inability to command and hold attention. An apparent dullness in students can frequently be traced to distraction caused by extraneous noises.

Noise reduction by absorption in the offending rooms, and particularly in corridors, makes concentration possible and furthers co-operation between students and instructors.



*The teller's cages of the First National Bank, Chicago, Ill., are noise-quieted with Sanacoustic*

### Offices and Factories

Business organizations have come to recognize that the comfort and health of their employees are matters of vital consequence, not alone from the standpoint of furthering amicable relations between management and employees but also from the point of increased output. Discussing the effect of noise upon workers of all kinds, Babson's Reports make the following comment:

"The increasing seriousness of industrial noise as a drag on efficiency, presents a problem to which most clients have paid little attention. Both in the factory and in the office the increasing volume and intensity of sound has reached a point where it ceases to be merely a nuisance and becomes a definite economic liability. As a result, efficiency has been reduced and production slowed up. Wherever office-quieting treatments have been installed there has been a decided im-



*Corridor of Thomas Edison School, Boston, Mass., with a ceiling treatment of Sanacoustic, tile design*

provement in efficiency. Wherever brains are active, noise costs money. We urge clients to examine the acoustic conditions in the various rooms of their offices and plants. Noise is today on every employer's payroll. Much of it can and should be removed."

Noise, in business offices and banks, is the result of increased noise-producing apparatus, the grouping together of large numbers of employees and the use of hard, dense interior finishes which are excellent sound reflectors and very poor absorbers.

Leading psychologists have shown that considerably more energy is required to do a given amount of work in a noisy room than in one which is quiet. The average office worker knows what a relief it is when the hum, rattle and clamor of office work ceases. This is due to the relaxing of the pressure on the brain and strain on the nervous system which results from noise.



*Sanacoustic, one of the most adaptable treatments, moderates distracting influences in this directors' room Mississippi Trust Company, St. Louis, Mo.*





*A Sanacoustic ceiling in the general office of the Caterpillar Tractor Company, Peoria, Ill.  
By reducing office noise, sound control increases efficiency*

**Results of Noise Reduction:** As an example of what may be accomplished through the abatement of noise, reference may be made to the results obtained from acoustical treatment installed in several large business offices. Properly applied sound-absorbing treatment in many cases represents a considerable investment, but one that returns a high dividend in the efficiency, contentment and health of workers. The following table shows the dividend-paying results obtained by the Western Union Telegraph Company in its telephone operating room.

Records on production, errors and costs were maintained for a period of four weeks before and after J-M sound-absorbing materials were installed. The following tabulation reveals the saving in the cost of messages and the reduction in errors after the installation of the noise-quieting treatment.

Weekly Average	Message load	Cost per message*	Errors, percent
4 weeks before installation	33781	1.016	0.427
4 weeks after installation	34503	0.985	0.246

\*These figures are on a relative basis only. Cost during the first week of test was designated at 1,000 per message. Thus the savings per message amounted to 3.05 percent of all the messages transmitted. The reduction in errors amounted to 42.4 percent.

On the basis of savings, the annual return on the investment in sound-absorbing materials (Sanacoustic, tile design), after charging off the depreciation and

interest, amounted to 67 percent. The savings effected paid for the installation in 1½ years.

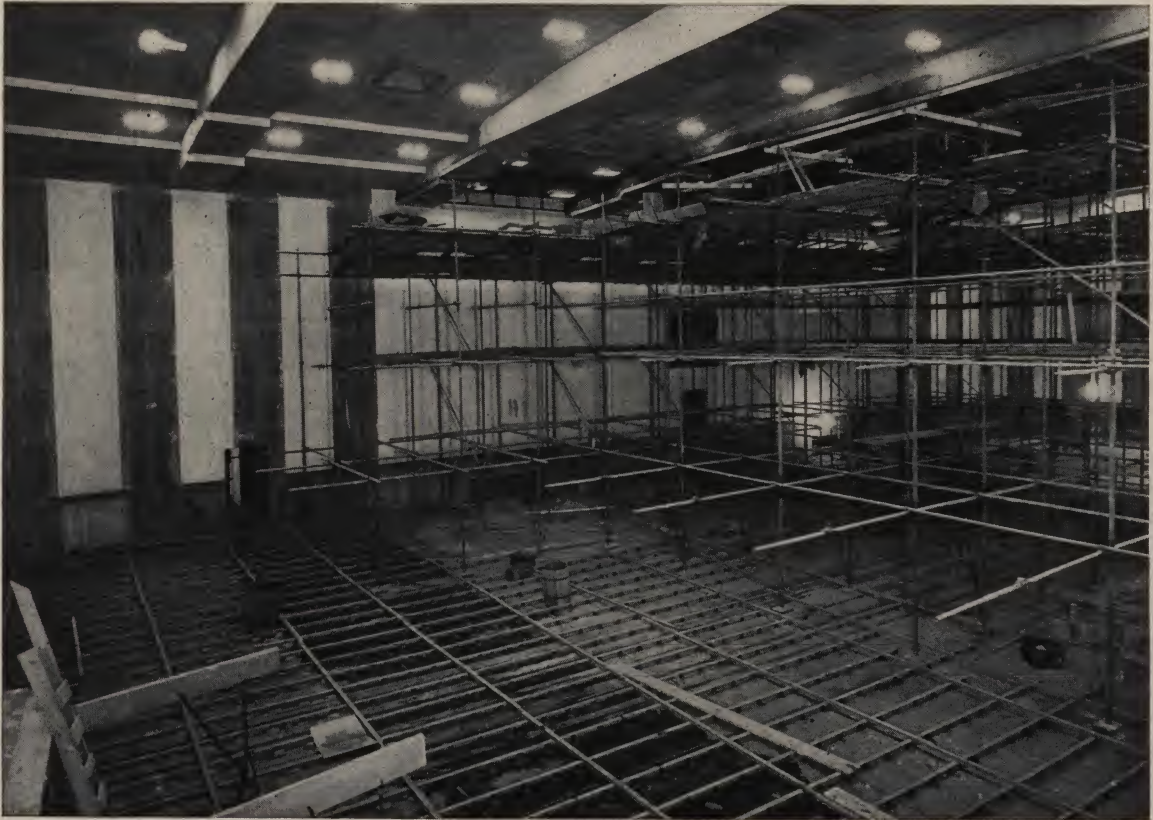
Another detailed study of the benefits derived from J-M sound-absorbing materials was made by the Rike-Kumler Company. In this case, the record of production was made for a period of six months before and four months after the installation in the large general office. The reduction of errors amounted to 24.5 percent. Compared with the advantages derived, the cost of the sound-absorbing installation was really very small. The daily cost per person was estimated at \$0.016, based on a conservative depreciation of 5 percent and conventional interest charges.

The Rike-Kumler Company, however, contended that the cost of correcting errors was negligible, compared to the loss of customer good will if, for example, the error was made in a customer's statement. This, one of the most important advantages, could not be evaluated in terms of money.

The records of many companies indicate an increase in efficiency and a reduction in errors of clerical workers when located in quieted offices. Creative workers, executives and others whose duties require the exercise of keen discrimination are affected by noisy surroundings even more than clerical workers—and a mistake in judgment is much more costly than a clerical error.



## Sound Isolation



*The floor, walls and ceiling of this auditorium studio are being sound-isolated from the building structure to prevent outside noises from interfering with broadcasting activities. Photograph, courtesy of National Broadcasting Co.*

The continuing rise in the noise levels of all large cities has a serious effect on health, comfort and efficiency. This truth, fast being realized by the public, requires that the problem of reducing noise and vibrations in buildings be given more attention by architects and building engineers.

In every structure, mechanical equipment is utilized to save time and effort of the occupants and to add to their comfort. The increasing use of elevators, air-conditioning apparatus, vacuum cleaners and other motorized equipment, while supplying these needs, leads to the generation of considerable noise and vibration. This, together with the fact that people are becoming more noise conscious, has necessitated the development of methods for the isolation of sound.

Sound which is transmitted by structural vibration can definitely be controlled. Light-weight and specially constructed floors, walls and ceilings can be entirely divorced from the building structure by means of felted isolators. This floating interior can be de-

signed to have no rigid contact with the outer solid structure and the isolators arranged to absorb the impact of sound waves and mechanical shock so that noise will not be transmitted. This method by which the continuity of structural vibration is broken, is known as the J-M System of Sound Isolation.

A well directed investment in sound control is good insurance against obsolescence of the building and dissatisfaction of its occupants. Commercial buildings may be used for more varied types of businesses and have a longer useful life. In other words, the installation of sound isolation provides a means of obtaining maximum revenue. Higher rents may be charged for apartments that eliminate the necessity of listening to the neighbor's radio and other activities overhead. It is reasonable to expect that tenants will appreciate and pay a premium for the additional comfort and privacy afforded by a sound-treated apartment.

Sound Isolation also permits many economies in design and construction such as locating ventilating





*The J-M System of Sound Isolation applied to wall and ceiling surfaces, ready to receive metal lath and plaster. Note felt-lined isolators on which steel furring is supported*

fans and motor generator sets where they are needed. These as well as other noise-producing service activities may be conveniently placed and sound isolated instead of grouped in out-of-the-way places. Theatres may be built next to bowling alleys and billiard rooms next to ballrooms if measures are taken to prevent the transmission of sound between them.

Sound Isolation treatments are advantageously installed in clubs or lodge buildings, in hotels, hospitals, libraries and industrial buildings where light manufacturing is conducted adjacent to office spaces. Where mass drills and games are in continuous session, the isolation of school gymnasiums makes possible the use of nearby classrooms for lectures, recitation and

study. Music instruction, band or orchestra practice rooms particularly require a sound isolation treatment.

Radio broadcasting studios must be completely isolated in order to permit accurate reproduction of music and speech. It is imperative that extraneous sounds originating in corridors, control rooms or other studios be kept from the microphone. Guarding against these noises necessitates studio isolation which actually constitutes a "room within a room."

Paralleling the requirements of radio studios are sound-proof test rooms for factories or laboratories where noise in manufactured products is investigated and controlled. Reliable studies of this nature depend, first, upon the ability of the isolated, quiet room



*The cushioned isolators of this sound-isolated floor are grouted to the building structure. The next operation is to spread Sound Isolation Fill, a sound-damping medium, between the stringers to prevent drum action*



lowest economic weight. For this reason, the reduction of sound transmission by increasing the weight and density of the building materials is not practical. The erection of double walls separated by an air space or by materials differing greatly in density is sometimes advocated as a means of sound isolation. Walls of this nature waste space, present structural difficulties and their efficiency is much reduced by the necessity of having solid through-connections.

**J-M System of Sound Isolation**

The principle of the J-M System of Sound Isolation is based on the erection of a light weight interior which is within, yet completely separated from, the rest of the structure. This is accomplished by means of shock-absorbing isolators. No solid, through-connections are used.

In this system, isolators, cushioned with hair felt, are installed at specified points to take up the impulses which otherwise would be transmitted through the construction. J-M Floor, Wall and Ceiling Isolators intercept the sounds, transform them into mechanical energy, and then absorb the energy.

The shock-absorbing units, called "chairs" or "isolators," types of which are illustrated on the front of this sheet, consist of metal supports or containers which are fastened both to the structure of the "outside room" and the "inside room." Held by the metal shape, between the two fastening elements, are one or more layers of heavy cushioning felt. Thus, as shown in the drawing, a means is provided for securing the finished interior surfaces to the structural wall,

**Adaptability**

The J-M System also has the advantage of providing structural unity. Because of this it is adaptable to a large variety of uses in buildings, from simple frame construction to the most modern fireproof designs. The treatment is easily applied and can best be installed during the erection of the building with little change in the schedule of operations. It is possible, however, to apply corrective measures at any time.

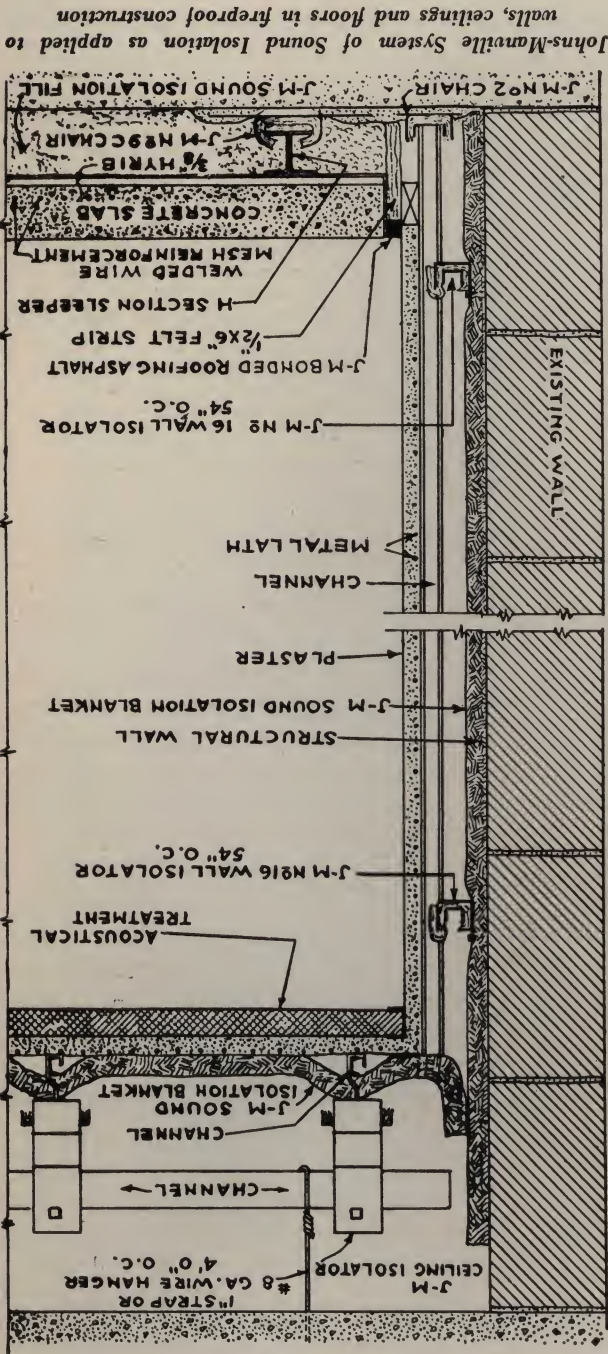
Constructions isolated by Johns-Manville years ago have been tested over long periods and have been found to retain their original efficiency. The present design of the various parts, which is the result of this experience, assures satisfactory installations with minimum cost and maximum sound isolation value.



*A J-M sound-isolated dance floor, shown under construction, is one of the necessary adjuncts to the modern ballroom. Such a structure provides resiliency in addition to preventing the transmission of sound*

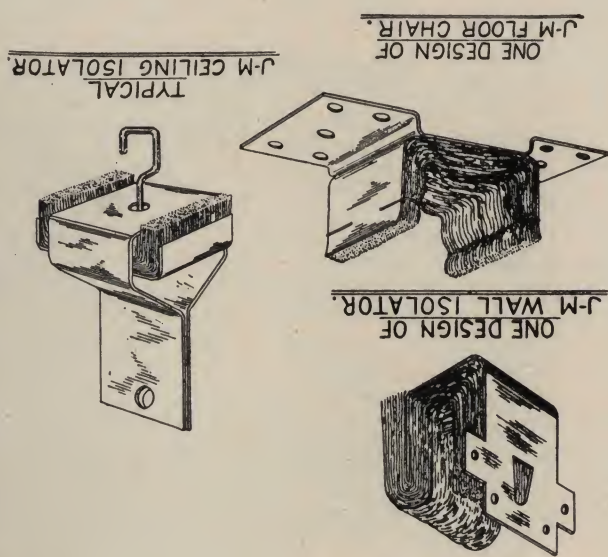


stated to be inversely proportional to the weight per square foot; that is, the heavier the partition, the less sound will be transmitted. Although dense, massive constructions resist the passage of air-borne sound, they are susceptible to the transmission of impact and machine vibrations. Even if heavy materials were effective vibration insulators, their use would be contrary to modern structural design which attempts to utilize materials of maximum strength consistent with



Overcoming the passage of sound and vibrations from one room to another is an entirely different problem from the control of air-borne sound by absorption. Obviously, no purpose is served by making a room acoustically perfect if there are disturbing noises of large magnitude present in an adjoining room. It might seem reasonable just to put sound-deadening treatment in the offending room. Experience has shown, however, that the interfering noise must be reduced to a very low level before it ceases to be troublesome. Acoustical materials alone may not be able to accomplish this result. On the other hand, an effective means of vibration control may not eliminate the need for sound-absorbing materials.

Sound goes through a partition either by finding its way through crevices and cracks or by setting the wall, itself, in vibration. Therefore, when isolating a partition, it is first necessary to see that there are no openings and that windows and doors fit tightly. The amount of sound transmitted through single walls, floors or ceilings by vibration may be roughly





## Sound Control of Mechanical Equipment

Mechanical equipment, introduced into both residences and working spaces, has caused the occupants to become increasingly conscious of the growing amount of noise.

Prospective customers for air conditioning systems are placing increased importance on quiet operation of equipment. This is particularly true when installations are being considered for offices, restaurants, stores and similar locations where excessive operating noises can annoy large numbers of occupants. In many locations—like hospitals, radio and sound film studios—quiet operation is absolutely essential. Yet all types of equipment usually produce noise of some kind. How to control this sound is discussed in the following paragraphs on air conditioning.

Noise created by ventilating equipment generally can be classed as either one of two kinds: That which is transmitted through the building structure, or that which is carried in the air through the ducts. Since noise which travels through the structure originates in the apparatus, it is convenient to deal first with methods of treating the unit itself.

### Equipment Room

All machines have a fundamental frequency at which they vibrate. This vibration is easily transmitted to the building structure by the machine and later converted into sound. In large air conditioning systems, the main source of this vibration usually is the blower. By resting the blower on flexible mountings it is possible to isolate the vibrations before they reach the main building structure. Either rubber or spring isolators are available to perform this function. Details can be obtained from manufacturers specializing in duct equipment.

It is essential that canvas or flexible connections be provided between fan or blower units and the duct systems. Otherwise, the vibration of the fan and motor may be transmitted by the ducts to all parts of the building. It is also desirable that all pipe be isolated from the duct system and from the building structure.

To prevent air-borne, equipment-room noises from escaping to surrounding areas in objectionable volume, the floors, walls and ceilings of this room should be lined with a suitable sound-absorbent material.



*Airacoustic Sheets are readily installed in all types of sheet metal duct construction. Note how smoothly the material is fitted into a typical bend*

### Duct Systems

The second type of noise created by air conditioning systems is that which is transmitted in the air through the ducts rather than by the ducts themselves.

This noise may originate in various parts of the ventilating system. Fan noises, air rush or air turbulence, sound which has entered from various parts of the building through the duct walls, cross talk carried between two or more rooms serviced by the same duct—all contribute to the total noise transmitted. The most efficient method of controlling this type of sound is to treat the interior of the ducts so that the sound will be absorbed before it reaches the outlet grille.

It is usually unnecessary to treat the entire length of the duct. Although there is no hard and fast rule by which to determine the extent of the treatment, satisfactory results are often obtained by treating the duct for a distance of at least ten times the average of its cross-sectional dimensions. Thus, a duct 8" x 12"



should be rendered sound absorbent for a distance of at least 8 ft 4" from its outlet.

Where ducts are unavoidably short, vertical baffles of sound-absorbent material should be installed to divide the ducts into smaller ones. This increases the absorbing surfaces sufficiently to permit satisfactory absorption of the sound before it can reach the outlet.

In the entire field of sound control there is no type of service which places more exacting requirements on sound-absorbing treatment than does duct lining. Not only must the material be highly sound-absorbent, but also fireproof and moisture-resistant. Furthermore, it must have a surface which will not materially increase friction losses. Finally, the lining should be odorless and vermin proof.

Of particular importance is fire resistance. Numerous bulletins have been issued on this subject by both the National Board of Fire Underwriters and the National Fire Protection Association in which serious duct fires were described. In these cases, the combustible material used for the lining of ducts caught fire and caused extensive damage. As a result, these organizations have taken the stand that only incombustible materials shall be used for duct linings.

### *Sound Control Materials for Mechanical Equipment Quieting*

Acoustical Cement, No. 132, is used for spot-cementing Airacoustic sheets. Furnished in 1 and 5-gal. container. One gallon covers about 60 sq ft of Airacoustic.

Airacoustic Sheets are non-combustible, moisture-resistant sound-absorbents which are used chiefly inside air-conditioning units and ducts. Manufactured in rigid form from mineral wool and a suitable binder. Net weight, 1½ lb per sq ft, 1" thick. Furnished 24" x 36", in thickness of ½", 1" and 1½".

Akoustikos Felt, composed of asbestos fiber and specially selected hair, is particularly desirable where a flexible sound absorbent is necessary. Supplied in 36"-wide rolls of approximately 180 sq ft, in ¼", ½", ¾" and 1" thicknesses. Respective net weight per roll is 53, 73, 104 and 135 lb. Rectangular-cut or die cut shapes furnished on special order.

Banacoustic Blankets are fireproof acoustical blankets used to quiet mechanical equipment. Made of mineral wool which is secured between metal lath of various types. Standard sizes

The above requirements may seem unusually rigid, but Airacoustic® Sheets meet the specifications completely. Airacoustic is a highly sound-absorbent material developed expressly for this type of work. The sheets will not support combustion because they are made of mineral wool, a product often used for fire-proofing.

Notable, too, is this material's resistance to moisture. Sheets placed in 90 percent humidity for one day will only absorb slightly over two percent moisture; when totally submerged for the same length of time, they will absorb less than 20 percent.

Airacoustic adds very little to the total air flow resistance of the duct system. Tests have shown that a lining of this material increases resistance only 16 percent over that of the unlined duct.

Airacoustic sheets are supplied 24" x 36" in ½", 1" and 1½" thicknesses. Generally, the ½" thickness is satisfactory for ducts supplying offices, machine rooms, corridors or other areas where there is a definite noise level. The 1" thickness should be used to line ducts that lead to private offices, conference rooms and similar locations where the noise level is low.

are 24" x 48" and 24" x 96" in 1", 1½" and 2" thicknesses. Flame-proofed muslin on one side is available on special order. Used in preference to Sound Isolation Blankets where greater rigidity is required. Cut pieces supplied on special order. Blanket No. 102 has 1"-wire mesh on both sides; No. 103 has stucco lath both sides; No. 112 has 1"-wire mesh on one side, metal lath on the other. Blanket No. 113 has 1"-wire mesh on one side, stucco lath on the other.

Sound Isolation Blankets Types KK and MK often find application in lining air-conditioning units and oil burner housings. They are composed of 1" and 2"-thick mineral wool stitched between sheets of fabric and paper. Type KK has flame-proofed Kraft paper on both sides; Type MK has flame-proofed muslin on one side and flame-proofed Kraft paper on the other. Type MK is supplied in rolls 22" and 36" wide and in thicknesses of 1" and 2". The 1" blankets are available in lengths of 50 ft and the 2" blanket in lengths of 25 ft. Type KK is supplied in 36"-wide rolls, 50-ft long for 1" thickness and 25-ft long for the 2" thickness.











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(See "Building Materials, Miscellaneous" Section)

(For complete list of data sheets, see other side of this page)



## Transite Products

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## Corrugated Transite



*Corrugated Transite is easily and rapidly applied*

A material for industrial roofing and siding construction must, in addition to possessing structural efficiency, withstand the many forms of destructive action which are common in chemical and metallurgical processes. For over thirty years Transite\* has continually proved its value as such a material, not only because of its durability and fire-resisting qualities but also because of its ease of application and freedom from painting or other maintenance.

Corrugated Transite is made of asbestos fiber and cement, formed under great pressure into dense, asbestos-cement sheets possessing unusual strength, rigidity and durability. Corrugated Transite sheets are designed for use as roofing, siding and partitioning, particularly over skeleton frame construction. This material has been extensively used by railroads, public utilities and industrial plants because of its exceptionally high resistance to acid fumes, alkaline vapors,

adverse atmospheric conditions and extreme and sudden temperature changes.

In the thousands of installations which have been made, every detail of construction has been thoroughly worked out to assure rapid, economical erection. Special fasteners have been designed, accessories made available in the form of ridge rolls, corner rolls, clips and louvers, and ventilators manufactured from Transite to meet a wide variety of requirements.

### Characteristics of Transite

#### *Resistance to Fire:*

Transite, in addition to being non-combustible, will withstand considerable temperature without cracking or buckling. This resistance to destructive agencies, while desirable under all conditions, is essential where combustible products are manufactured. In the event of a fire in one of a closely related group of buildings, Transite prevents the destruction of the entire

\* Reg. U. S. Pat. Off.





The exterior of this large airport control tower was constructed of fire-, weather- and corrosion-resistant Transite

plant by confining the fire to its source. This is well illustrated by the large use of the material as a roofing over stills in oil refineries where it has proved effective in preventing the spread of fire from one unit to another. No other material, so adaptable to general building construction, surpasses Transite in resistance to fire.

#### *Resistance to Weather and Corrosion:*

In chemical industries, Corrugated Transite provides resistance to the corrosive attacks of practically all of the common acid fumes and gases, such as exist around gas plants, coke ovens, smelters and other metallurgical equipment. Where roofing and siding previously had to be replaced frequently, Transite has been in use for many years without the necessity for maintenance or replacement.

Similarly, the extremes of climatic conditions do not deteriorate Transite. Neither is it affected by rain and salt corrosion even where the atmosphere is heavily charged with chemical vapors and dust which is dissolved in the rain to form acid.

Where condensation collecting on the under side of a roof and on steel girders would be likely to cause trouble, the J-M Insulated Rot-proof Roof or the Transite Insulated Roof may be employed in conjunction with the Corrugated Transite. The added insulation of either of these constructions reduces heat transmission to a point where condensation will be prevented and there will be no damage to equipment through water dropping from overhead framing. For example, such roofs are usually recommended over paper machines or exposed electrical equipment.

#### *Resistance to Temperatures and Steam:*

Alternate dry and wet conditions or high and low temperatures, common to many industrial operations, do not harm Corrugated Transite. It may be used over open vats, in boiler rooms and wherever steam, irrespective of its temperature or condition, is likely to come into contact with the roofing and siding.

The coke-quencher offers an outstanding example of this "shock-proof" quality. A car loaded with glowing coke, radiating heat at a temperature of about 1700 F against the Transite, is run into the quencher, and the cold water is turned on. Some of this water strikes the Transite, the rest hits the glowing coke and is promptly converted into steam. This steam strikes the water-cooled siding, and escapes to the atmosphere. This process is repeated in frequent cycles during the working day. Transite is the only corrugated material which has satisfactorily withstood the rigors of this unusual service.

#### *Durability and Economy:*

Like many other products made of cement, Transite actually becomes tougher and stronger with age and stands up for years under conditions which destroy other forms of roofing and siding. Since it requires no protective painting or other maintenance expense and because it reduces fire risks to a minimum, Corrugated Transite is decidedly economical. Accurate records of users indicate that Transite assures the longest life and lowest per annum cost.

#### *Physical and Structural Properties:*

**Strength:** The great pressures used in combining the asbestos fiber and cement, together with the reinforcing action of the asbestos fibers, produce a surprisingly strong sheet. This permits application over widely spaced supporting members: on roofs up to 54", and on siding up to 66", center to center. Where



structural design permits accumulation of snow and ice to cause excessive loading, however, the purlin spacing in such areas shall be reduced to 45" or even less in extreme cases. While Corrugated Transite possesses ample strength for the usage intended, it should not be subjected to overloading or undue shocks. Workmen should use "chicken ladders" on all roofing work. (Corrugated Transite meets Federal Specification SS-R-524.)

**Appearance:** Transite, light cement gray in color and uniform in texture, presents an attractive appearance. Its light-reflecting properties are often of advantage not only for interiors but also for exteriors in reflecting the heat of the sun. Transite can be painted, if desired, by applying a chlorinated rubber enamel, preferably, or with a heavy coat of boiled linseed oil and at least two coats of a good exterior paint. Complete directions for painting cement-asbestos products appear on a separate data sheet.

**Ease of Application:** Transite requires no special tools for application and it can be installed as rapidly, in the same general way, as any other corrugated material. It can be drilled with electric twist drills, fastened with screws or bolts and sawed with a hand saw, though a portable power saw with an abrasive wheel

or carbide-tipped blade should be used if much sawing is to be done. Special fasteners, which are supplied on order, further facilitate erection over various types of framework.

**Perfect Nesting of Corrugations:** An important feature of Corrugated Transite is that inside and outside radii of the corrugations are the same, assuring perfect nesting and a good seal against water and wind. There are two methods of assembly illustrated on page entitled "Construction Details." The first utilizes sheets with square corners, resulting in Staggered Joint Construction. The second employs cut corner sheets, resulting in Straight Joint Construction.

### Where Corrugated Transite Is Used

In the following brief outline, a few of the many interesting and widely varying applications of Corrugated Transite are reviewed.

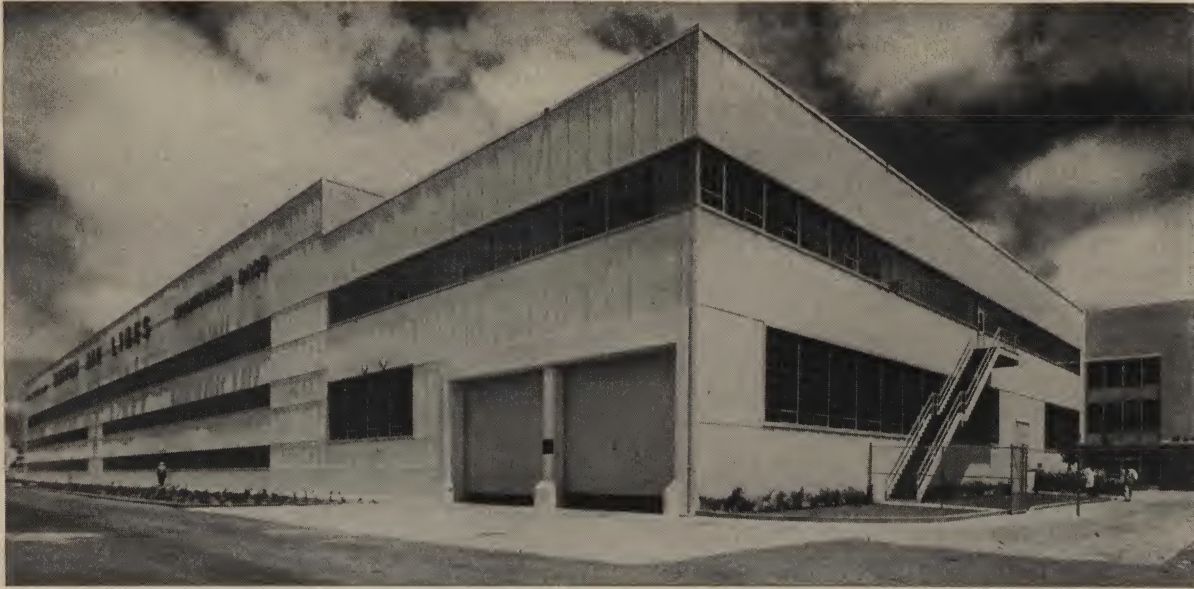
**Oil Refineries:** For fireproof aprons and roofs over stills, housings of various types, and for "flare-back" walls around tanks to prevent spread of burning oil to adjacent tanks.

**Railroads:** For switch towers, freight houses, way stations, and relay, battery and tool sheds, pedestrian overpasses, smoke baffles, roundhouses and car shops.



*Corrugated Transite sheets are particularly designed for application over skeleton-frame construction*





*A large airlines base designed with maintenance-free walls of Corrugated Transite*

**Chemical and Metallurgical Industries:** For these industries Transite solves some of the most aggravating building problems, due to its resistance to the majority of commercial acid fumes. Whether used in gas and coke plants, electro-chemical industries, smelters, refineries, or in any other location, Transite affords continual protection.

**Mines and Quarries:** The material is applied as roofing and siding on hoist houses, loader and crusher sheds, storehouses and similar structures.

**Coal Conveyor Housings:** Transite housings are employed in many public utilities and industrial plants where large quantities of coal are handled.

**Warehouses and Docks:** Due to the unusual fire hazards, Transite is widely used.

**Airports and Terminals:** Fire resistance, light-reflection, easy erection, low cost and appearance are essential qualities fulfilled by Transite for garages, airports, terminals and similar buildings.

**Fair and Exposition Buildings:** Transite is especially adapted to this type of construction, which is used only intermittently and represents a large investment, both in first cost and in re-conditioning. With Transite, erection costs are held to a minimum, and maintenance costs are practically eliminated.

**Farm Buildings:** Transite's resistance to fire, weather and wear makes this material ideal for use in farm construction. Machine sheds, corn cribs, milk houses, cow barns, and other farm buildings can be easily and economically built of Corrugated Transite.

**Sea Coasts:** Transite is ideal for sea coast buildings because it is totally unaffected by the deteriorating action of severe wind and salt spray conditions.

### **Corrugated and Flat Transite**

Corrugated Transite is often used in combination with Flat Transite, especially for the smaller types of buildings, such as employees' houses, sheds, tool houses and similar structures. In such cases corrugated is used for roofing and flat material for siding. Battens, also made of Transite, are placed over the butt joints on the siding, providing an obstruction against wind and rain. Architects and decorators employ flat and corrugated sheets to work out unique, modern designs in stores and exhibits.

**J-M Curtain Wall Construction:** A curtain wall made up of  $1\frac{1}{16}$ " Transite and Corrugated Transite will provide a construction equal in insulating value to approximately 22" of brick. Light in weight, this modern, dry-wall construction is suitable for walls or partitions in warehouses, plants, hangars or other buildings where an insulated structure is desired.

**Employee Housing:** Companies operating in locations which require the maintenance of employee housing facilities use Transite very effectively to produce economical, fire-resisting houses of attractive appearance. The possibility of practically complete salvage, when panel wall construction is used, increases the advantages of Transite for this type of building.



## Corrugated Transite Dimensions and Weights

Corrugated Transite sheets have corrugations with a 4.2" pitch and a depth of 1½". The sheets are approximately 7/16" thick at ridge and valley of the corrugations.

Sheets are furnished 42", or ten corrugations, wide. Standard lengths are listed below:

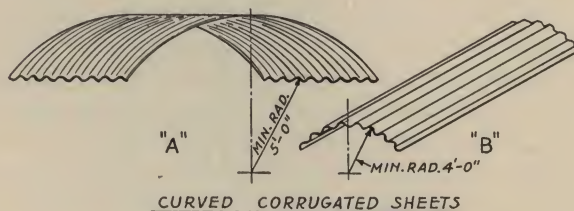
Length	Sq Ft Area	Length	Sq Ft Area
0'6"	1.75	6'0"	21.00
1'0"	3.50	6'6"	22.75
1'6"	5.25	7'0"	24.50
2'0"	7.00	7'6"	26.25
2'6"	8.75	8'0"	28.00
3'0"	10.50	8'6"	29.75
3'6"	12.25	9'0"	31.50
4'0"	14.00	9'6"	33.25
4'6"	15.75	10'0"	35.00
5'0"	17.50	10'6"	36.75
5'6"	19.25	11'0"	38.50

**Weights:** Corrugated Transite weighs approximately 4.1 lb per sq ft, gross area, unstrapped.

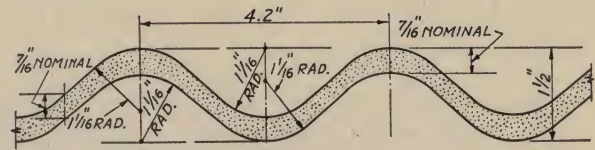
**Sized Sheets:** The dimensions listed above are approximate. Sheets cut to accurate size can be furnished at a slight extra charge for sizing. Unless otherwise specified, standard sheets will be shipped.

**Cut Sheets:** Sheets can be furnished any desired width or length that can be cut from standard sizes. Such special size sheets will be charged for on the basis of the next larger standard size. Diagonal and longitudinal cutting, where required at gables, windows or elsewhere, will be charged on a sheet basis; battens are cut from sheets on a linear foot basis.

**Curved Sheets:** Curved sheets are manufactured to order. The minimum radius when curved lengthwise, with the arc parallel to the length of sheets, is



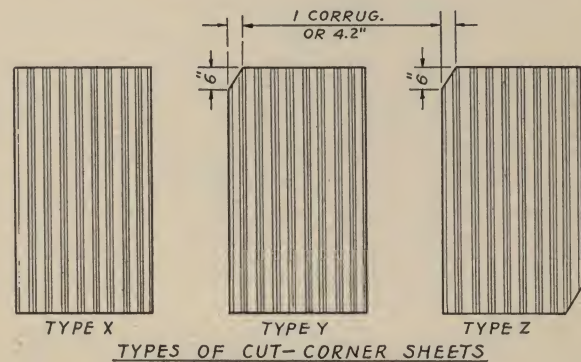
60" (See drawing "A" above). When curved crosswise, with the arc parallel to the width of sheets, the minimum radius is 48" (See drawing "B" above). A sheet may be curved either way, but not both ways.



CORRUGATED TRANSITE SHEET DIMENSIONS

### Types of Corner Construction:

Corrugated Transite sheets are furnished in three types: Type X with all corners square; Type Y with one corner cut; and Type Z with two diagonal corners cut. The three types are shown below. The square-cornered sheets, Type X, result in staggered joint construction and the sheets with cut corners enable Transite to be laid with straight horizontal and vertical lap lines. The latter kind involves a slight additional cost because of the cut corners.



### Accessories:

Transite accessories are illustrated in drawings appearing elsewhere in the data sheets on this subject.

**Ridge Rolls** are Transite units used to cover the joint at the ridge. Type P Ridge Rolls are furnished 7" in diameter, approximately 3/8" thick in lengths of 10-ft. Battens for Type P Ridge Roll are applied on the inside of the ridge roll to cover the joint where two sections butt together. Type P Battens are furnished approximately 3/8" thick and 6" long.

**Type W Corner Roll**, is manufactured with its rough surface in; **Type W Eave Trim**, with its rough surface out. Both are supplied 1/4" thick in 8-ft lengths with 7" wings on a 90-deg bend. **Type U Battens**, used to cover butt joints, are 1/4" thick, 6" long with 7½" wings on a 90-deg bend.





*Main building of a large aircraft plant with walls of Corrugated Transite and a fascia of Flat Transite*

Louver Blades, made of Corrugated Transite, are supplied in average thickness of  $\frac{3}{8}$ ",  $2\frac{1}{2}$  corrugations or approximately  $10\frac{1}{4}$ " wide, and lengths up to 11 ft. Construction details are shown on other data sheets.

Transfalt Strips, made of preformed asphalt, are designed for flashings at various points on the corrugated structure. Three types are available: Type O for the upperside of the sheets, Type I for the underside of the sheets and Type R for use between Ridge Roll and the Corrugated Transite roof sheets.



*Modernizing a plant economically by applying J-M Corrugated Transite to the original frame structure*

J-M Rope Putty or J-M Black\* Plastic Cement must be used for cementing laps of roofing sheets. Gray putty is used to cover exposed fasteners other than the lead-head type. Rope putty  $\frac{7}{16}$ " dia., talced and supplied wound on reels, provides a superior flashing. The black and gray putties are supplied in containers of convenient sizes.

Corrosion-resisting bolts, drivescrews, washers and clips of various types, designed especially for use with Corrugated Transite, are shown in detail elsewhere.

#### **Erection:**

Skilled labor is not needed for the proper erection of Corrugated Transite. Because of the convenient sheet sizes and the accessories available, this material can be speedily applied by the average workman.

Corrugated Transite shall not be laid on roofs having a pitch of less than 3" per foot; a pitch of 4" or more is preferred.

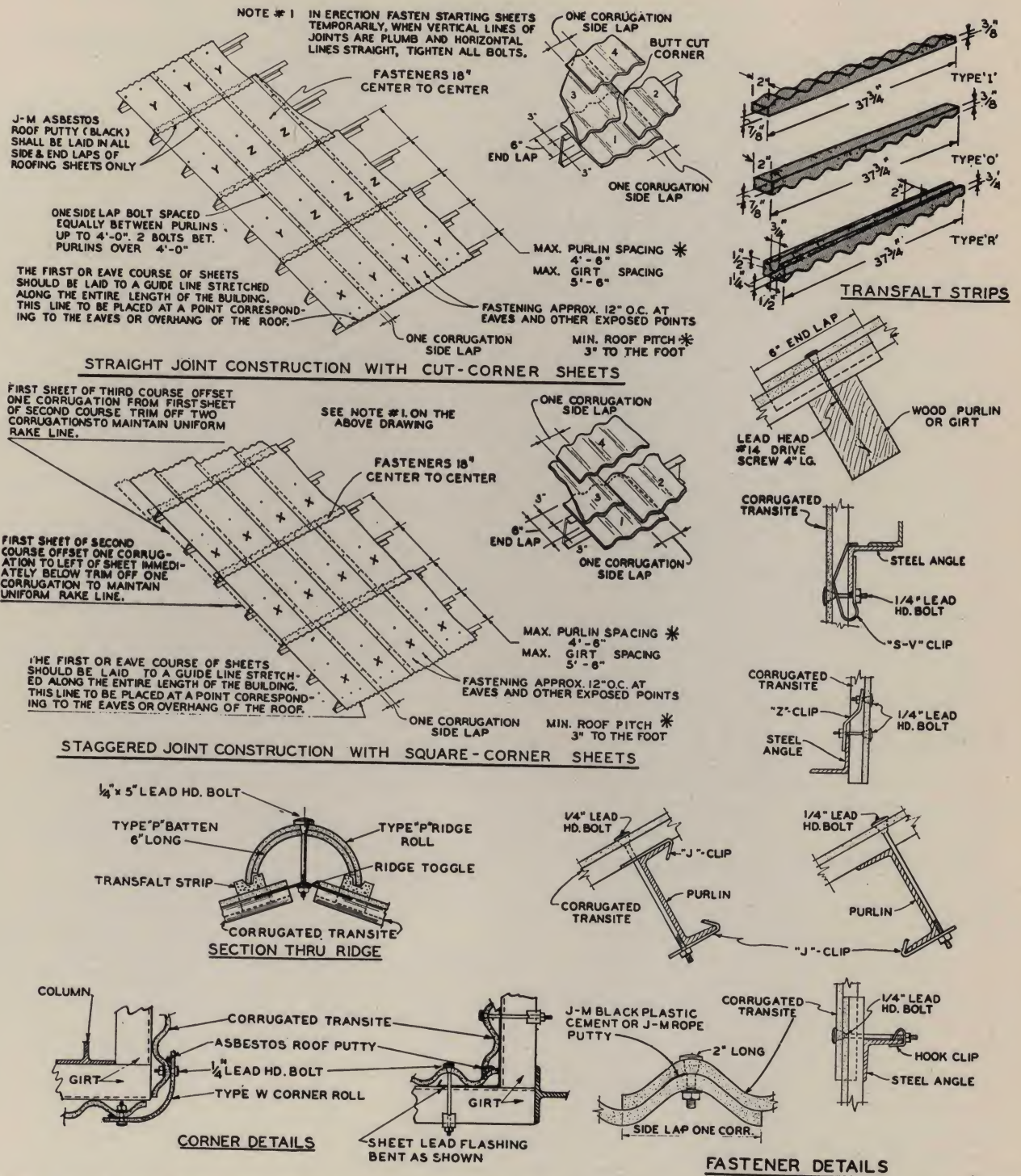
Roofing and siding shall be applied with a side lap of one corrugation, 4.2", to give a weather exposure of approximately 37.8". End laps shall be not less than 6" and must occur over purlins or girts. Purlins should not be spaced on greater than 54" centers, and side-girts on centers not greater than 66". In areas where structural design permits accumulation of snow and ice to cause excessive loading, reduce purlin spacing to 45" (or less in extreme cases) and increase minimum roof pitch to 4".

Complete directions for the erection of Corrugated Transite are given on other data sheets.

\* Caution: Do not use "Gray" Putty and avoid smearing the Black Plastic Cement on the exposed face of the sheets.



# Construction details for 4.2" Corrugated Transite

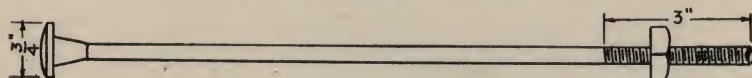


\* IN AREAS WHERE STRUCTURAL DESIGN PERMITS ACCUMULATION OF SNOW AND ICE TO CAUSE EXCESSIVE LOADING, REDUCE PURLIN SPACING TO 45" (OR LESS IN EXTREME CASES) AND INCREASE THE MINIMUM ROOF PITCH TO 4".

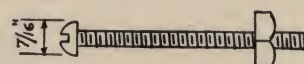
NOTE: BOLT LENGTHS FOR "J" AND HOOK CLIPS = DEPTH OF STEEL PLUS 3", EXCEPT THROUGH 3 THICKNESSES OF CORRUGATED TRANSITE WHERE LENGTH SHOULD = DEPTH OF STEEL PLUS 4".



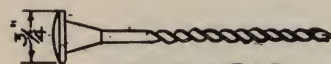
## Corrugated Transite Fasteners



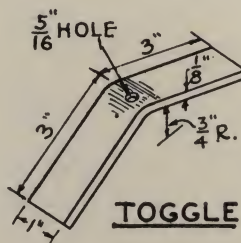
LEAD HEAD BOLT



ROUND HEAD BOLT



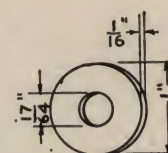
LEAD HEAD DRIVE SCREW



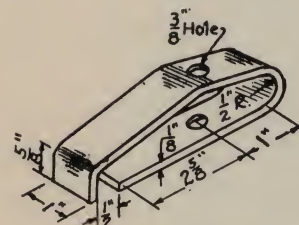
TOGGLE



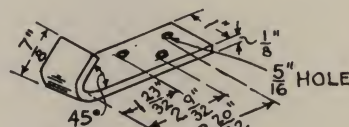
LEAD WASHER



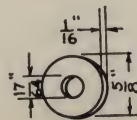
WASHER



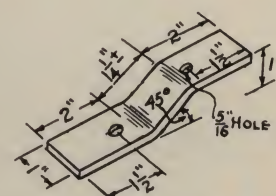
SV CLIP



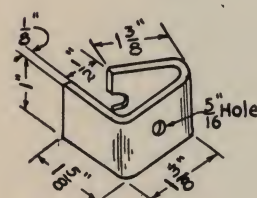
J CLIP - 3 HOLE



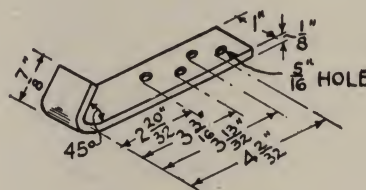
WASHER



Z CLIP



HOOK CLIP



J-CLIP - 4 HOLE

Type of fastener	Length in inches	Type of finish	No. per lb	Type of fastener	Length in inches	Type of finish	No. per lb
1/4" Lead Head Bolts	2	(See Footnote) *	18	Lead Head Drive-screws	No. 14x3	Galvanized	16
"	3	"	15	"	No. 14x4	"	14
"	4	"	13	Washers	1x1 7/8	"	74
"	5	"	11 1/2	"	5/8 x 1 7/8	"	225
"	6	"	10	Washers (lead)	3/4 x 1 1/4	(Lead Cupped)	77
"	7	"	9	Hook Clip		Galvanized	7
"	8	"	8 1/2	J Clip—3 Hole		"	7 1/2
"	9	"	8	Toggle		"	4 3/4
"	10	"	7	J Clip—4 Hole		"	6
"	11	"	7	Z Clip		"	5 1/2
"	12	"	6 1/2				
"	13	"	6				
1/4" Stove Bolt	1 1/4	"	56	SV Clip		"	3
"	1 1/2	"	49				
"	1 3/4	"	44				
"	2	"	40				
"	3	"	28				

\* Note: Corrosion-resistant finish.



## Typical Installations of Corrugated Transite



*Corrugated Transite is particularly economical when used for roofing and siding on large buildings. Note that the platform canopy on this building is of cantilever construction, eliminating obstructive posts*



*Transite is easily adapted to difficult types of building construction such as this sawtooth roof*



*Fireproof and enduring, Corrugated Transite is the ideal building material for conveyor housings*

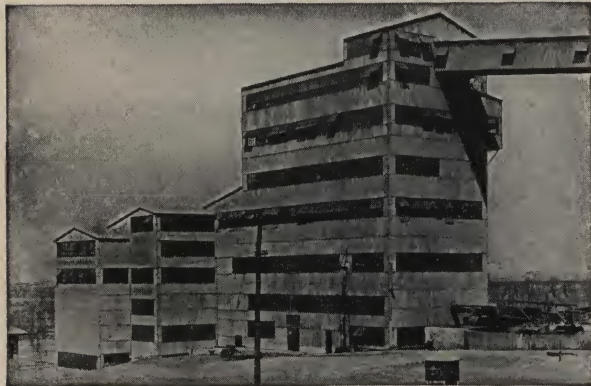


*Because it is fireproof, rot-proof and extremely durable, Transite is being utilized on all types of farm buildings*





*The Corrugated Transite roof of this grandstand needs no painting to preserve it, thereby minimizing maintenance costs*



*Large coal breaker which is roofed and sided with Corrugated Transite for fire safety and low maintenance*



*Salt air rapidly deteriorates water-side buildings—but not if they are constructed of Corrugated Transite*



*Transite is used as smoke baffles and fire stops on piers because of its resistance to corrosion and flame*



*Erected with straight lap lines, Corrugated Transite presents an attractive appearance on large wall areas*



## Transite Walls



*J-M Asbestos Movable Walls are attractive and modern in appearance. They are easily dismantled and relocated*

J-M Asbestos Movable Walls are modern, demountable partitions, developed to fill the need for a superior type of partition which not only permits quick revision of floor layouts but also provides the protection and privacy so frequently lacking in flimsy, old-fashioned partitions. They are easy to erect or relocate, and have good resistance to fire and sound. There is a Johns-Manville partition that will solve any layout problem requiring movable walls.

Employing dry materials exclusively, J-M Partitions are erected without the dirt and disorder that accompanies the same work done with masonry and wet materials. Mechanically fastened, they can be easily disassembled and relocated. Moreover, all parts—doors, borrowed light frames, wickets, grilles, transoms, hardware, even the wall panels themselves—are standard and interchangeable, permitting 100 percent salvage of materials.

Despite their money-saving adaptability to quick revision of layout, these walls retain all the natural advantages of permanent walls—solid appearance, durability, fire- and sound-resistance. The hard asbestos

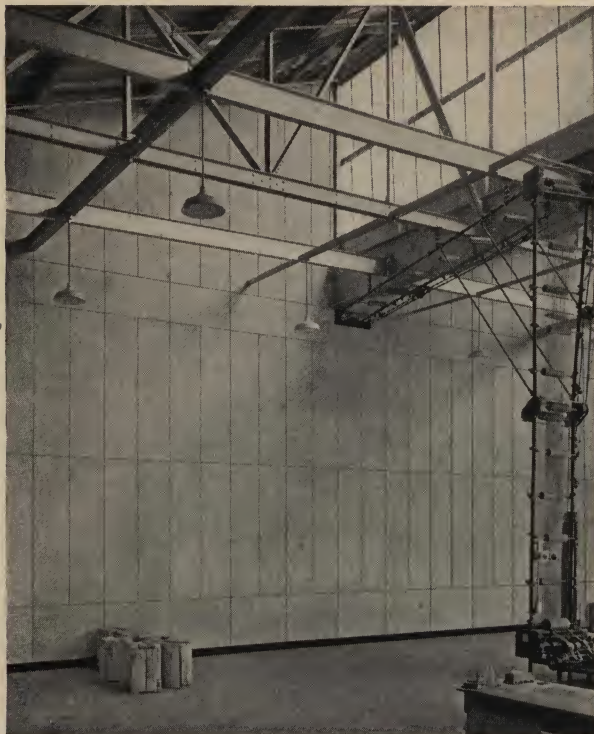
facing materials used with the partitions will neither burn nor deteriorate.

There are four types of J-M Walls: Transitone®, Imperial Transite®, Class-A and Universal. The first two types mentioned employ patented steel studs on which asbestos panels are hung by means of concealed fasteners; the latter two are economical, prefabricated partitions. The following conventional constructions can be produced with speed and economy:

1. Ceiling-high walls, including doors, and borrowed lights (single or double glazed) and susceptible to almost unlimited variety of decorative treatment.
2. Low, free-standing partitions, flush or glazed, and with provision for being simply and easily carried up to the ceiling with top fillers.
3. Standard office railings ranging from low rail to bank screen, with glass, the necessary gates, wickets, doors and other conventional requirements.
4. Removable radiator enclosures.
5. Wall facings using Transite or Transitone on steel studs are frequently used to cover the unsightly interior of outside building walls, ventilating shaft risers, etc.
6. Economical, easy-to-erect toilet compartments.

All of the above constructions are erected with a minimum of labor, disturbance and delay.





*Over 36-feet high, this Asbestos Movable Wall provides a sound- and fire-resistant barrier between the press and shipping rooms of a large publishing house*

### Advantages of J-M Movable Walls

The actual dollars and cents savings gained by the use of J-M Movable Partitions are readily apparent. Walls can be disassembled and erected with carpenter's tools by the regular building maintenance crew. Wrecking and waste involved by destroying a wall in one location and then purchasing materials and hiring labor to erect another a few feet distant is avoided. Further savings are effected by having neither the floors nor ceilings seriously disfigured.

In addition to reducing the expense of relocation, Movable Walls minimize the disturbance created by a revision of wall layout. With these partitions, major changes can be made overnight. Minor alterations can be made during business hours with little interruption to employees' activities. Changing the location of J-M partitions involves moving a minimum number of parts, the largest of which can be transported from floor to floor inside an elevator cab. The parts are standard and interchangeable, thus minimizing the purchase of materials for replacement purposes.

The interior of a room built with J-M Movable Walls may be finished to meet the requirements of an executive office or of a janitor's closet. One side of the wall

may be finished with Transitone, the asbestos sheet that is colored all the way through. The reverse may be painted or given an entirely different treatment. Lacquers, veneers, fabrics or other factory finishes also can be applied to satisfy almost any decorative need. If desired, immediate field painting is permissible because of the use of dry, preformed panels.

As a fire retardant, Imperial Transite Walls have been accepted by the Bureau of Buildings of New York and other large cities where walls capable of passing a one-hour fire test are used. Transitone walls also meet the requirements for a one-hour fire wall.

The following paragraphs summarize briefly the characteristics of J-M Movable Walls and Partitions:

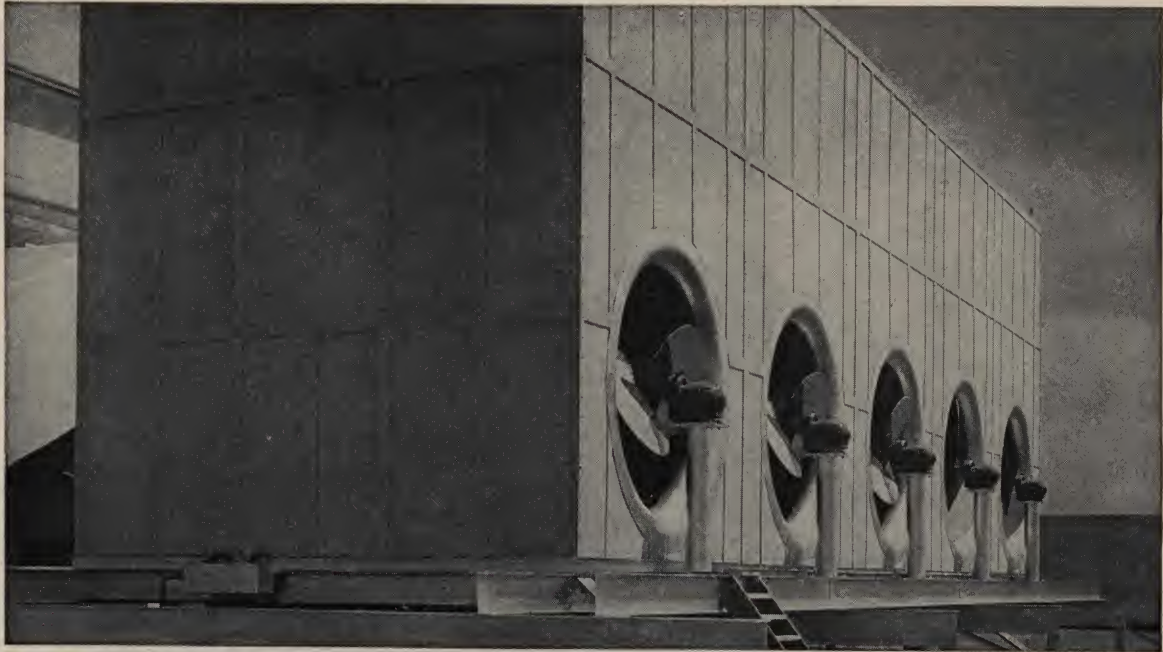
1. Distinctive interior decorative finishes varying from the pleasing pastels of integrally colored Transitone to veneers of the most exotic woods.
2. Imperial Construction can be made more sound-resistant than any other type of movable partition.
3. Speed and simplicity of erection, made possible by exclusive patented construction features.
4. Small, easily handled units can be transported inside elevator cabs from stock to floor location, and require small space for storage.
5. Low-cost erection or dismantling, with minimum disturbance and dirt.
6. No special tools required. Ordinary carpenter's tools can be used for complete erection and disassembly.
7. No trained labor necessary. Changes in detail or relocation of offices can be made by the maintenance staff, over night, if required.
8. Pre-decorated walls, with the toughest and most abuse-resistant finish of any movable partition.
9. If the color flexibility of field painting is desired, immediate painting is possible. All the materials are dry. No long delay for plaster drying before the decorative plans can be completed.
10. No disturbance or cutting of floor finish. This assures a minimum of patching when the partition location is changed.
11. Economical relocation of offices or walls made quickly, with no loss of materials.
12. Rapid installation or relocation of doors, wickets and other accessories, with little expense or disturbance.
13. Easy and economical conversion of solid walls into walls with borrowed lights, or vice versa.
14. Safe, adequate and out-of-sight provision for electric, telephone and office signal-system wiring. Transitone and Imperial Transite Walls will also accommodate plumbing and heating lines and small ventilating ducts.
15. Adaptability to any type of space or service condition.
16. Unusually fire-resistant, rust-proof and durable.
17. Little or no maintenance expense.

### Cost Comparisons

J-M Asbestos Walls, notwithstanding their many advantages, are competitive in price with other forms of movable partitions. Although the initial cost of these partitions may be greater than a conventional, permanent wall, one alteration or change will pay a positive return on an investment in this modern, flexible partition system.



## Flat Transite Asbestos Sheets



*Flat Transite sheets, which are both fireproof and durable, are used to enclose this forced draft cooling tower for a large auditorium*

Transite\* is generally recognized as the outstanding fire- and corrosion-resisting building sheet on the market today. It is composed of asbestos fiber and cement, which are united under great pressure into dense, monolithic sheets of remarkable strength, rigidity and durability.

Transite is light gray in color and weighs approximately 124 lb per cu ft. It can be drilled with twist drills, fastened with screws or bolts and sawed with a hand saw (set 5 to 7 points to the inch). A portable power saw with an abrasive wheel should be used if much cutting is to be done in the field. For information on shop practice, see other data sheets.

Transite does not become warped, distorted or weakened in service; in fact, it actually strengthens and toughens with age. It offers high resistance to acid fumes and severe weather conditions. It has withstood severe fire tests and is widely used where resistance to fire is important. Painting, finishing or other protection against weathering is not required.

Flat Transite is exactly the same material as Corrugated Transite, except for form. It is suitable for use under constant temperatures up to 600 or 700 F, and much higher temperatures of short duration. The

characteristics of Transite are gone into in greater detail in connection with the description of the corrugated material on other data sheets.

**Finishes:** Flat Transite has sufficient smoothness for practically all purposes. Thicknesses of  $\frac{1}{4}$ " to  $\frac{3}{4}$ " have a tolerance of  $\pm \frac{3}{64}$ ";  $\frac{3}{4}$ " and over,  $\pm \frac{1}{16}$ ".

Flat Transite is also available with one or both sides sanded to full nominal thickness. Transite sanded on one side will have a tolerance of  $\pm \frac{1}{32}$ "; when sanded on both sides tolerance will be  $\pm \frac{1}{64}$ ".

Thickness tolerance for polished Transite, one or both sides, will be  $\pm \frac{1}{32}$ ".

Unless otherwise specified, standard unsanded material is always furnished.

### *Painting and Cleaning:*

If Transite is to be painted, it should be given coatings of chlorinated rubber paints or a priming coat of boiled linseed oil and two coats of a good exterior paint. Pencil marks on Transite can be removed with art gum or sand paper.

Complete painting directions and further cleaning instructions are given on data sheet titled "Painting and Removing Stains from Cement-Asbestos Products."

\* Reg. U. S. Pat. Off.



### Where Flat Transite Is Used

Because of its strength, resistance to both fire and corrosion, weatherproof qualities, comparatively light weight, attractive appearance and durability, the applications of Transite are practically unlimited. It finds a wide use in thousands of industrial plants as well as in hospitals, libraries, office buildings, railway stations, machine shops, garages and residences.

### General Industrial Uses:

In all types of industrial plants, Flat Transite is used for walls, ceilings and partitions. Its easy workability and the speed with which the large units can be erected are important advantages. Transite is also used in industrial plants for housing of various types and for ducts, bins, table and bench tops and many other uses requiring a durable sheet material.

### Furnace Casings:

It is an ideal material for casings over insulation on furnaces, boilers, tanks and other heated equipment. The  $\frac{3}{8}$ " thick material is recommended, particularly on the larger types of equipment and where removable panel construction is required. Its relatively light weight, low thermal conductivity, and its corrosion-resistance, attractiveness and light-reflecting features combine to make Transite highly satisfactory.

### Residential Construction:

Transite is equally well adapted to interior and exterior use. Fire-resisting walls, ceilings and partitions, etc., for various types of construction, can be readily made of this material.

It lends itself particularly well to half-timber effects and for the construction of summer cottages and bath houses. It can be readily applied directly over wood or steel studding. Vertical and horizontal joints are covered with battens of the same material, of the width and thickness desired. Battens can be painted as required for architectural effects.

### Sizes and Weights of Flat Transite

Flat Transite is furnished as shown in the following table of nominal sheet sizes and thicknesses:

Nominal Sheet Size, Inches	Thickness, Inches
36 x 48	$\frac{1}{4}$ to 2
42 x 48	$\frac{1}{4}$ to 2
42 x 96	$\frac{1}{4}$ to 2
48 x 48	$\frac{1}{4}$ to 2
48 x 96	$\frac{1}{4}$ to 2

Uncut sheets run somewhat full in length and width because much of this material is cut on the job into smaller sizes and the oversize sheets give an allowance for saw kerfs. If requested, however, sheets in the above sizes and panels cut to a special size can be furnished to specified dimensions plus or minus  $\frac{1}{32}$ ". This tolerance applies only to dimensions at time of cutting at the factory. The length and width dimensions may vary when the material is received owing to shrinkage or expansion caused by varying atmospheric conditions in transit and storage.

Sheets can be drilled, countersunk, polished and beveled at the factory, if desired.

### Thickness and Weights (Uncut Sheets)

Thickness, inches	Approximate weights in lb per sq ft	
	Uncrated	Crated
$\frac{1}{4}$	2.7	3.1
$\frac{5}{16}$	3.3	3.9
$\frac{3}{8}$	4.0	4.6
$\frac{1}{2}$	5.2	6.0
$\frac{5}{8}$	6.5	7.5
$\frac{3}{4}$	7.8	9.1
$\frac{7}{8}$	9.0	10.4
1	10.3	12.3
$1\frac{1}{4}$	12.2	14.2
$1\frac{1}{2}$	14.6	18.0
$1\frac{3}{4}$	17.0	20.5
2	19.4	23.0

Transite is also furnished in corrugated sheets approximately  $\frac{3}{8}$ " thick, 42" wide and in lengths of from 6" to 11 ft. Corrugated Transite is fully described in other data sheets.

### Maximum Allowable Spans of Flat Transite

Thickness, inches	Ceiling, inches	Wall, inches
$\frac{1}{4}$	24	36
$\frac{5}{16}$	32	39
$\frac{3}{8}$	36	42
$\frac{1}{2}$	42	48
$\frac{5}{8}$	45	54
$\frac{3}{4}$	49	60
1	54	72

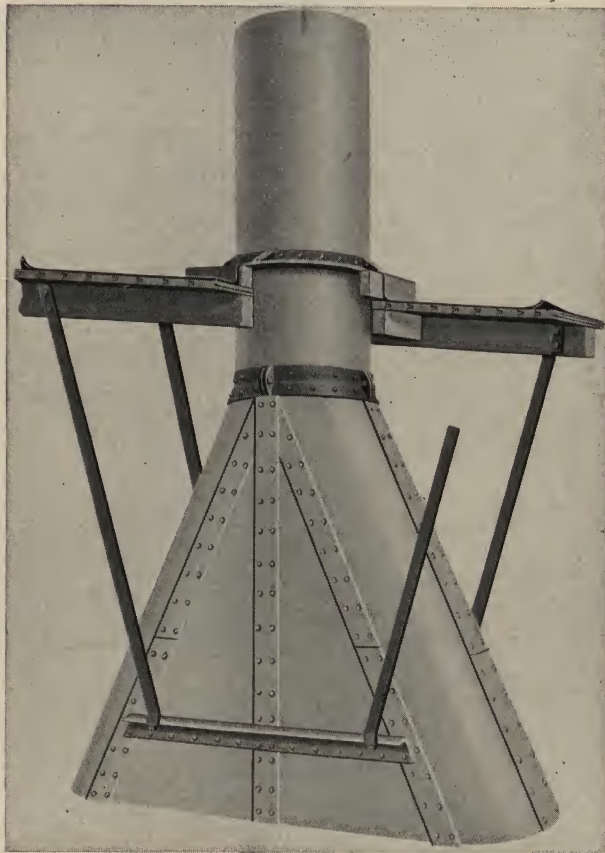
Flat Transite sheets may be curved or moulded, in manufacture, to suit requirements. The sheets may be curved in any one direction, with a minimum radius of curvature depending upon the sheet thickness. Transite is also moulded into ducts, smoke jackets, etc., as described in other data sheets.



## Transite Smoke Jacks

The purpose of the smoke jack is to exhaust the stack gases of locomotives from the roundhouse. The ideal jack is efficient in performing this function over a long period of years with little or no maintenance expense. Transite Smoke Jacks have fulfilled these requirements for more than a quarter century. Improvements in design have constantly been effected but the fundamental service requisites, based on the use of Transite, are the same at the present time as they were in the beginning.

The life of any smoke jack, as well as the maintenance required, depends primarily upon the material of which it is made. Its efficiency in exhausting smoke and fumes from the locomotive stack, and clearing the roundhouse of obnoxious gases, is dependent upon its shape and size and the relation of its component parts.



*The Type Pc Smoke Jack is typical of the Class P group, the latest development in smoke jack design*



*Type J Transite Smoke Jacks in the roundhouse of an engine terminal*

Transite, the material used by Johns-Manville for smoke jack construction, is a combination of asbestos fiber and cement, united under tremendous pressure to form a dense, monolithic substance of great strength and durability, which is remarkably resistant to corrosion.

The design of Transite Smoke Jacks is in accord with the fundamental principles of roundhouse smoke disposal. Standardized sizes and styles are available which meet the needs of practically any installation to be encountered.

### Classes of Transite Smoke Jacks

Three classes of Transite Smoke Jacks are manufactured: Class P Smoke Jacks, Moulded Smoke Jacks and Cut Smoke Jacks. Each class is available in either a ventilating or non-ventilating type. Recommendations for use will be furnished by Johns-Manville and where unusual service conditions exist, special designs can be supplied.

#### *Class P Smoke Jacks:*

The Class P Smoke Jack is the latest Johns-Manville development in smoke jack design and construction. Involving the use of Transite Pipe (Transite specially processed), this jack fulfills the exacting requirements of efficient smoke removal and long life with little or no maintenance.

The hood of the smoke jack is so constructed that the corner pieces are quadrants of Transite Pipe joined lengthwise and at the sides with flat Transite. The



stack is an integral unit of 36"-diameter Transite Pipe of the desired length.

This construction produces a smoke jack of great strength, minimum number of parts, and a one-piece stack in which all fastenings and corner posts or battens are eliminated. The contour of the jack is such that eddy currents and gas pockets are reduced to a minimum, giving a high rate of gas removal.

Such a design not only affords maximum durability and freedom from maintenance expense, but also desirably simple and economical erection.

#### *Moulded Smoke Jacks:*

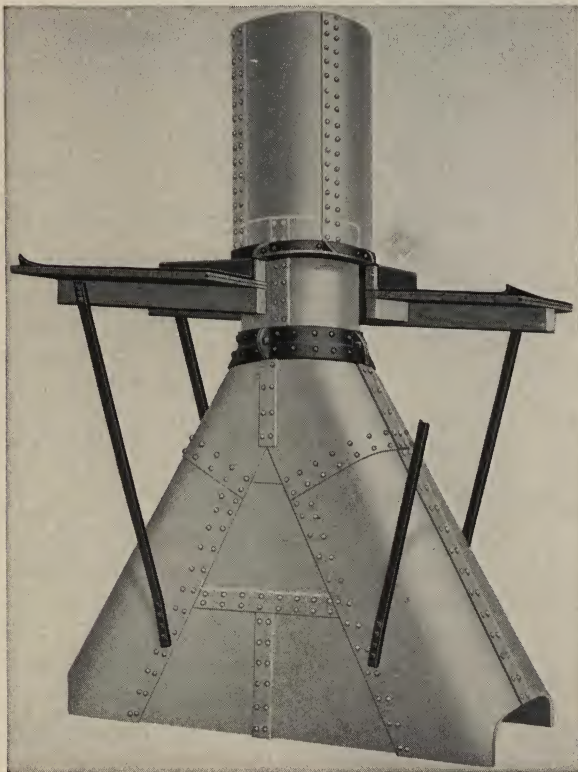
The Moulded Smoke Jack is designed with the sloping corners of the hood and the stack constructed of moulded, curved sections of Transite, and the sides of flat Transite. Like the Class P Jack this design largely eliminates the formation of eddy currents and gas pockets, giving a uniform flow of gas through the smoke jack.

#### *Cut Smoke Jacks:*

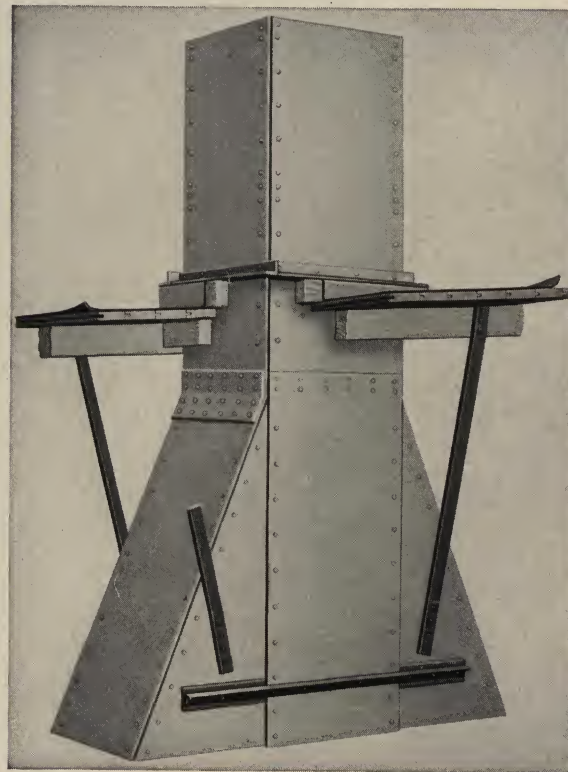
This design is fabricated entirely from flat Transite sheets, thus producing a hood with square corners and a square or rectangular stack.



*The thirty Type K Transite Smoke Jacks erected in this roundhouse assure a minimum amount of smoke jack maintenance expense*



*Moulded Ventilating Transite Smoke Jack, Type K*



*Cut Non-ventilating Transite Smoke Jack, Type Az*



### Methods of Ventilating

Transite Smoke Jacks may be obtained, when desired, with a ventilating feature to clear the roundhouse of gases which may rise outside the hood as the locomotive enters or leaves the roundhouse.

This is accomplished with the cut and moulded jacks by the use of two concentric stacks, the inner

stack telescoping into the larger or roof stack, thus providing an annular opening at the roof line to exhaust the gases.

With the Class P Smoke Jack, ventilation is accomplished by having a larger roof opening than the stack of the jack. An umbrella is then attached to the stack above the roof as a protection from the weather.

### Johns-Manville Transite Smoke Jacks

Type of Jack	Drawing Number	Design of Jack	Dimensions of Jack				
			Hood			Stack Section	
			Length	Width	Height	Inside Stack To Hood	Outside Stack Ventilating Only
<b>Cut Smoke Jacks</b>							
Az	R-1017	Non-Ventilating	10'-0"	3'-6"	7'-4"	Square, 42" x 42"	
AY	R-1018	Non-Ventilating	10'-0"	3'-6"	7'-4"	Rectangular, 21" x 42"	
Aw	R-1019	Non-Ventilating	10'-0"	3'-6"	5'-0"	Rectangular, 21" x 42"	
AV	R-1020	Ventilating*	10'-0"	3'-6"	7'-4"	Square, 42" x 42"	Square, 42" x 42"
AN	R-1021	Ventilating	11'-0"	3'-6"	8'-3"	Square, 42" x 42"	Square, 48" x 48"
AE	R-1022	Ventilating	10'-0"	3'-6"	5'-0"	Square, 42" x 42"	Square, 48" x 48"
<b>Moulded Smoke Jacks</b>							
G	R-1009	Non-Ventilating	10'-0"	4'-0"	5'-6"	Oval, 18" x 41"	
H	R-1010	Ventilating	10'-0"	4'-0"	5'-6"	Oval, 18" x 41"	Oval, 24" x 46"
J	R-1014	Non-Ventilating	12'-0"	4'-0"	9'-6"	Round, 36" dia.	
K	R-1015	Ventilating	12'-0"	4'-0"	9'-6"	Round, 36" dia.	Round, 42" dia.
L	R-1016	Non-Ventilating	10'-0"	4'-0"	6'-3"	Round, 36" dia.	
<b>Class P Smoke Jacks</b>							
PA	R-1023	Non-Ventilating†	10'-0"	3'-6"	4'-11"	Round, 36" dia.	
PB	R-1024	Non-Ventilating†	10'-0"	3'-6"	7'-6"	Round, 36" dia.	
PC	R-1025	Non-Ventilating†	12'-0"	3'-6"	9'-6"	Round, 36" dia.	

\*Type Av Jack is equipped with a ventilating hood at the base of the outside stack.

†All Class P Jacks may be made "ventilating" by a roof opening and umbrella.



The sixty-five Moulded Ventilating Transite Smoke Jacks in service at this large engine terminal are representative of the success of the Transite material in resisting the highly corrosive action of the acid atmospheric conditions created by stack gases

#### TRANSITE SMOKE JACKS

November, 1940 (Cancelling sheet dated March, 1937)

BMT-361



### Smoke Jack Accessories

**Cement and Fasteners:** All metal fasteners used in the assembly of the smoke jacks are protected from corrosion by covering the exposed parts with J-M Smoke-Jack Cement, applied with the button-head mold. The cement is furnished in 10, 25, 40, 50 and 150-lb containers.

**Caps:** When so desired, Transite Caps can be furnished for all types of smoke jacks. Under practically every condition, however, a cap presents an obstruction to the proper flow of smoke from the stack, so that it should not be used.

**Dampers:** Dampers can be provided for any type of smoke jack, if required, but their use is discouraged except in very cold climates.

**Flashing Plates and Angles:** Where the stack of the smoke jack goes through the roof a curbing is used. The stack is flashed to the top of the curbing with cast iron flashing plates for the Class P and Moulded Jacks, angle irons for the Cut Jacks and stack feet for certain ventilating (roof) stacks.

**Hangers:** In the majority of cases, the weight of a smoke jack will be such that the use of four wrought-iron hangers bolted to the jack and to the roof timbers will be sufficient to support and suspend the jack properly. In exceptional cases, where the jacks are unusually large, it is recommended that a special form of cradle support be provided.

### Transite Forge Jacks

The requirements of forge jacks are very similar to those of smoke jacks for roundhouses. Transite is an ideal material for this service also.

Due to the variety of types and sizes forges, it is not practical to adopt standard designs, therefore designs are prepared for each individual job. The same general details of smoke-jack design developed for roundhouses are followed, and either ventilating or non-ventilating forge jacks may be obtained with flat or moulded hoods and square, rectangular or round pipe stacks of any desired length. The stacks are usually much longer than required for smoke jacks.

## Transite Smoke Ducts

When roundhouses are located within city limits where local ordinances prevent the use of smoke jacks, some other form of smoke disposal system must be substituted. Under such conditions, the installation of a Transite Smoke Duct, in conjunction with exhausting fans and smoke washing tanks, will adequately meet the requirements.

Transite Smoke Ducts can be furnished in round or square cross sections, in practically all sizes up to 72"-diameter round duct, and 8 ft by 8 ft square duct.

The round duct is constructed in sections joined together by both horizontal and circular strips in the same manner as the stacks of the moulded smoke jacks. The square duct is constructed in sections joined together with square corner posts and flat batten strips, in the same manner as the stacks of cut smoke jacks.

Smoke ducts are also furnished made from Transite Pipe in diameters up to 36". The ducts are constructed from lengths of pipe joined with caulked couplings to form a straight or angled joint. Multiple ducts may be used where the number of stalls to be served is greater than the capacity of the largest duct available, the 36"-diameter pipe.

The smoke duct must, of course, conform to the curvature of the roundhouse. Likewise, the size of the duct must increase with the number of stalls to be ac-

commodated. Therefore, it becomes necessary to design each installation separately. When laying out a system of this kind, detailed drawings of the roundhouse must be provided. Over each stall a special stack is installed to convey the smoke from the locomotive stack into the duct that serves the roundhouse.



*Square Transite Smoke Duct installed in a large roundhouse. The size of the duct increases with the number of stalls*



## Transite\* Core Plates and Slip Jackets

To help assure maximum production in both ferrous and non-ferrous foundries, Johns-Manville furnishes Transite Core Plates and Transite Slip Jackets.

Both products are made from a specially treated compound of asbestos and cement. They are widely used by firms manufacturing castings of brass, aluminum, gray iron, malleable iron and steel. Light in weight, yet strong and durable, these materials provide outstanding economical advantages because of their low initial cost and long life.

Characteristics, sizes and weights of these products are given in the following paragraphs.

### Transite Core Plates

Transite Core plates are smoothly sanded trays of asbestos and cement for holding cores during the drying or baking processes. Some of the advantages of Transite Core Plates are:

**Light-Weight:** Ease of handling results in faster production in the foundry.

**Corrosion-Resistant:** Asbestos-cement composition provides resistance to corrosion. Surface remains smooth even after years of service.



*Weighing much less than metal, Transite Core Plates are easily handled*

\* Reg. U. S. Pat. Off.



*Where speed and accuracy prevail, Transite Core Plates provide superlative performance*

**Low Warpage:** On plates under 24" the maximum warpage is  $\frac{1}{64}$ " on either dimension. On plates over 24" the warpage will not be more than  $\frac{1}{64}$ " in 24" length and width.

**Easily Cleaned:** Core wash, sand, etc., do not stick as readily as to other materials. The practice of using both sides of Transite Core Plates in putting them through the core ovens automatically burns off the core washes and produces clean plates.

**Strong and Durable:** Transite Core Plates are made from a composition of two of nature's most enduring materials—asbestos and cement.

**Economical:** Initial low cost plus longer life in comparison with other materials help provide outstanding economical advantages wherever used.

**Perforated Core Plates:** Available on special order, Perforated Core Plates eliminate green cores and speed up baking—for cores of large mass and low surface area.

Transite Core Plates are furnished from 6" through 60" long and from 6" through 48" wide in 3" increments, with a manufacturing tolerance of plus or minus



$\frac{1}{16}$ " for both length and width. Thicknesses, thickness tolerance and approximate weights are shown in the table at the right.

Transite Core Plate stock is not furnished in large sheets for field cutting because of the impossibility of properly sealing the edges of the sheets with impregnant on such jobs.

Corners are rounded with radius equal to the thickness of the unit. Thickness of a unit required varies with the necessary area. Deflection difficulties may result from using units which are thinner than recommended in the table below.

### Thicknesses and Approximate Weights

Thickness*, inches	Weight, lb per sq ft	
	Uncrated	Crated
$\frac{1}{4}$	3.1	3.3
$\frac{3}{8}$	4.4	4.7
$\frac{1}{2}$	5.2	5.7
$\frac{5}{8}$	6.7	7.2
$\frac{3}{4}$	7.6	8.2
$\frac{7}{8}$	8.7	9.4
1	9.9	10.7
$1\frac{1}{4}$	12.8	13.8
$1\frac{1}{2}$	14.0	15.2
$1\frac{5}{8}$	15.3	16.6
$1\frac{3}{4}$	16.9	18.3
2	19.6	21.2

\* Thickness may vary plus or minus  $\frac{1}{32}$ ".

### Thickness in Inches Required for Given Areas

Length, inches	Width, inches														
	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
6	$\frac{1}{4}$														
9	$\frac{3}{8}$	$\frac{3}{8}$													
12	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$												
15	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$											
18	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{5}{8}$										
21	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{3}{4}$									
24	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$								
27	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{7}{8}$							
30	1	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{7}{8}$	1	1						
33	$1\frac{1}{4}$	1	$\frac{7}{8}$	$\frac{7}{8}$	1	1	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$					
36	$1\frac{1}{2}$	$1\frac{1}{4}$	1	1	1	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$				
39	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$			
42	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2	2		
45	2	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2	2	2	2	
48	2	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2	2	2	2	2
51	2	2	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2	2	2	2	2	2	2	2
54	2	2	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2	2	2	2	2	2	2	2
57	2	2	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2	2	2	2	2	2	2	2
60	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2



Transite Slip Jackets retain their original shape despite spill-overs and run-outs

### Transite Slip Jackets

Transite Slip Jackets have the same basic characteristics and advantages as Transite Core Plates. They retain their original shape despite spill-overs and run-outs. Warpage does not exceed  $\frac{1}{32}$ " on either dimension for jackets under 24".

Transite Slip Jackets are furnished in pieces, accurately cut to size and tapered, for assembly by the customer. Hardware is not furnished. Dimensions and weights are shown in the table below.

### Dimensions and Approximate Weights

Thickness*, inches	Length **, inches	Weight, lb per sq ft	
		Uncrated	Crated
$\frac{5}{8}$	Through 20	6.7	7.2
$\frac{3}{4}$	Over 20 through 30	7.6	8.2
$\frac{7}{8}$	Over 30 through 40	8.7	9.4

\* Thickness may vary plus or minus  $\frac{1}{32}$ ".

\*\* Width as specified.



## Transite Pipe

The conveyance of liquids and gases is so essential to modern industrial and community life that uninterrupted, economical service is imperative. To provide such service, whether in the transportation of liquids or in the venting of fumes or flue gases, the pipe must resist the distintegrating action of many different agencies. For this reason, Transite\* Pipe, which is composed of enduring and inert materials, provides unusually satisfactory service.

Transite Pipe is composed of asbestos, cement and silica combined under heavy pressure on a smooth steel mandrel into a dense, homogeneous structure. This pipe offers the primary advantages of easy installation, economical service and long life.

Because of its composition and the method of its manufacture, Transite Pipe is suited to a wide range of uses, including water, sewer and process lines, flues, vents and stacks. Among its outstanding advantages are high flow capacity, unusual resistance to corrosion, complete freedom from tuberculation and electrolysis, and incombustibility. In addition, light weight and simple coupling design contribute to quick and economical installation.

Thousands of miles of Transite Pipe have been installed in the United States and Canada for use as underground water mains, sewer mains, building sewer lines, process lines, flues, vents and stacks.

\* Reg. U. S. Pat. Off.



*The many advantages of Transite Sewer Pipe afford substantial economies*



*Transite Pressure Pipe provides thousands of cities and towns with efficient water distribution service*

### Types of Transite Pipe

The six types mentioned below are fully described on separate data sheets.

**Transite Pressure Pipe:** Pressure Pipe is designated as Classes 100, 150 and 200, which indicate the maximum recommended working pressures in psi. Furnished in 13-ft lengths, 4" through 36" diam.

**Transite Sewer Pipe:** Sewer Pipe is manufactured in Class 1 and Class 2, which indicate their resistance to crushing. Supplied in 13-ft lengths, in diameters of 6" through 36" for Class 1, and 10" through 36" for Class 2.

**Transite Industrial Vent Pipe:** Industrial Vent Pipe is furnished in 10-ft lengths in diameters of 3" through 7", and in 13-ft lengths in diameters of 8" through 36".

**Transite Flue Pipe:** Flue Pipe is supplied in round cross section in 5 and 10-ft lengths in diameters of 3" through 7", and in 6½" and 13-ft lengths in diameters of 8" through 12". Oval Flue Pipe is furnished in 5 and 10-ft lengths with oval interior cross sections of 2¼" x 4¼", 2¼" x 6⅝", 2¼" x 9¾", 2¼" x 11¼" and 1⅝" x 8⅛".

**Transite Building Sewer Pipe:** Furnished in 10-ft lengths in diameters of 4", 5" and 6".

**Transite Warm Air Duct:** The duct is supplied in round cross section in diameters of 3" through 8" in 10-ft lengths.

#### TRANSITE PIPE

March, 1953 (Cancelling sheet dated August, 1951)

BMT-400



### Physical Properties

When asbestos fibers, cement and silica are combined, under pressure, a very strong material is produced. The asbestos fibers are thoroughly mixed with the cement and serve as a reinforcement. The tensile strength of these fibers runs as high as 400,000 psi. These factors provide uniform strength values throughout the material. The toughness and strength of Transite Pipe are directly traceable to the reinforcement of the asbestos fiber. Furthermore, the method of steam curing Transite assures maximum strength and durability. During this curing process, the silica combines with the free lime in the portland cement to produce a highly stable product. The wide range of classes in which the pipe is manufactured provides for the many requirements of different service conditions encountered.

Because of its non-metallic nature, Transite Pipe cannot rust, is immune to tuberculation and electrolysis, and has unusual resistance to corrosion. The method of manufacture produces an unusually smooth interior surface which assures maximum carrying capacity for both liquids and gases.

The relatively light weight of Transite Pipe permits faster installation and more economical handling. All but the largest sizes of Transite Pipe can be handled



*Transite Industrial Vent Pipe provides an economic solution to venting problems*

without mechanical equipment. Each type and class of pipe is carefully designed to afford maximum efficiency in assembly.

### Uses of Transite Pipe

In general, Transite Pipe is recommended for services as outlined in the typical applications listed in the following paragraphs.

**Transite Pressure Pipe:** Used for water supply and distribution mains, pressure sewer lines, fire lines, mine-drainage lines, irrigation lines, brine lines, and many types of process lines such as stock and white water lines in paper mills.

**Transite Sewer Pipe:** Used for all kinds of gravity sewer lines, and outfall sewers.

**Transite Industrial Vent Pipe:** Used for stacks and vents for industrial purposes, laboratory vent systems, air ducts, and exhaust and blower systems.

**Transite Flue Pipe:** Used for venting domestic gas-burning appliances.

**Transite Building Sewer Pipe:** Used for lines carrying waste from buildings to street sewers or from buildings to septic tanks.

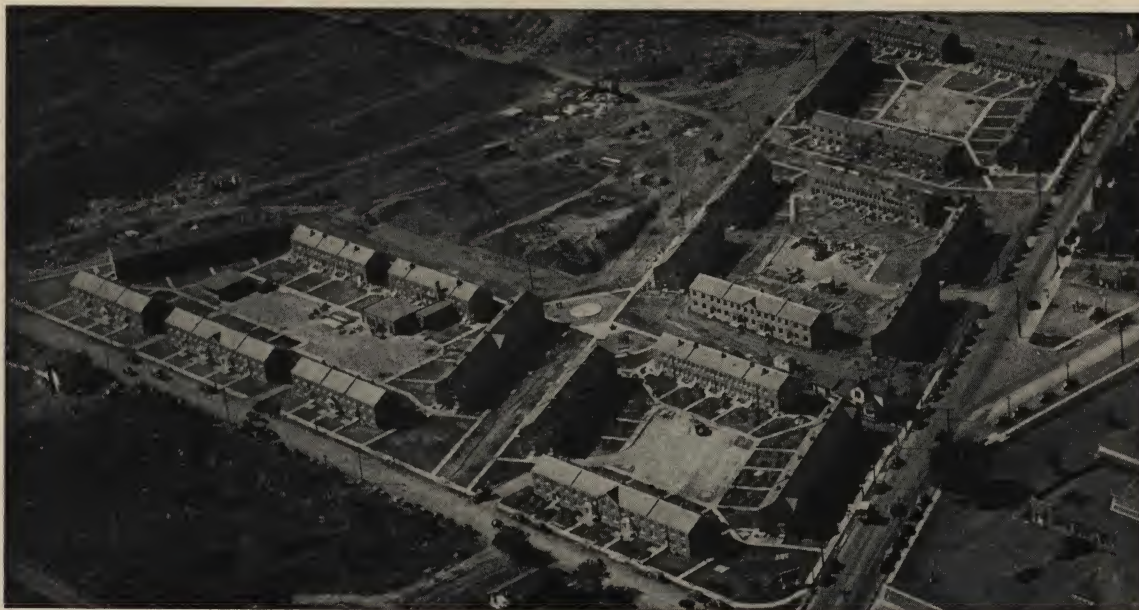
**Transite Warm Air Duct:** Used for conveying warm air in perimeter heating systems in slab-construction, basement-less houses. Also used for return cold air ducts and year-around, air-conditioning ducts.



*Transite Flue Pipe affords efficient service in venting*



## Transite Flue Pipe



*One of the large housing projects where Transite Flue Pipe was selected for venting*

For nearly twenty years Johns-Manville Transite\* Flue Pipe has been used for venting gas-burning appliances. Especially designed for this service, Transite Flue Pipe is made of asbestos and cement—two materials which have long been noted for their natural durability, fire-resistance and pleasing appearance.

Transite Flue Pipe has been listed as an approved material by the Underwriters' Laboratories, Inc., for use as an outlet and vent pipe on all gas-burning appliances producing temperatures up to 550F at the outlet of the draft hood when burning gas at the manufacturer's input rating, and when 1½" ventilated clearance is provided between the flue pipe and the combustible material.

### *Sizes and Shapes:*

**Round Pipe:** Transite Flue Pipe is furnished in round cross-section in sizes from 3" to 12" inside diameter. Sizes from 3" to 7", inclusive, are furnished in 5-ft. lengths; larger sizes, 6½-ft. lengths. Also available in 3" through 7" in 10-ft. lengths and larger sizes in 13-ft. lengths. The round flue pipe and fittings are furnished with tapered couplings which are unattached.

Round Transite Flue Pipe is also available with socket joints for use in flues, an application often

necessary when gas-burning appliances are to be vented through existing chimneys. No couplings are necessary with this type of pipe; thus the outside diameter of the flue pipe represents the maximum clearance required. Socket-joint pipe is available in 13-ft. lengths with inside diameters from 3" through 12".

**Oval Pipe:** Transite Flue Pipe is also furnished in oval cross-section, in lengths of 5 ft., for use where it is desired to run a flue through an interior partition or exterior wall constructed of 4" studs.

The interior cross-section of oval pipe are 2¼" x 4¼", 2¼" x 6⅝", 2¼" x 9¾" and 2¼" x 11¼". The outside narrow dimension of these four sizes is 2¾". The corresponding dimension of all oval couplings is 3⅝".

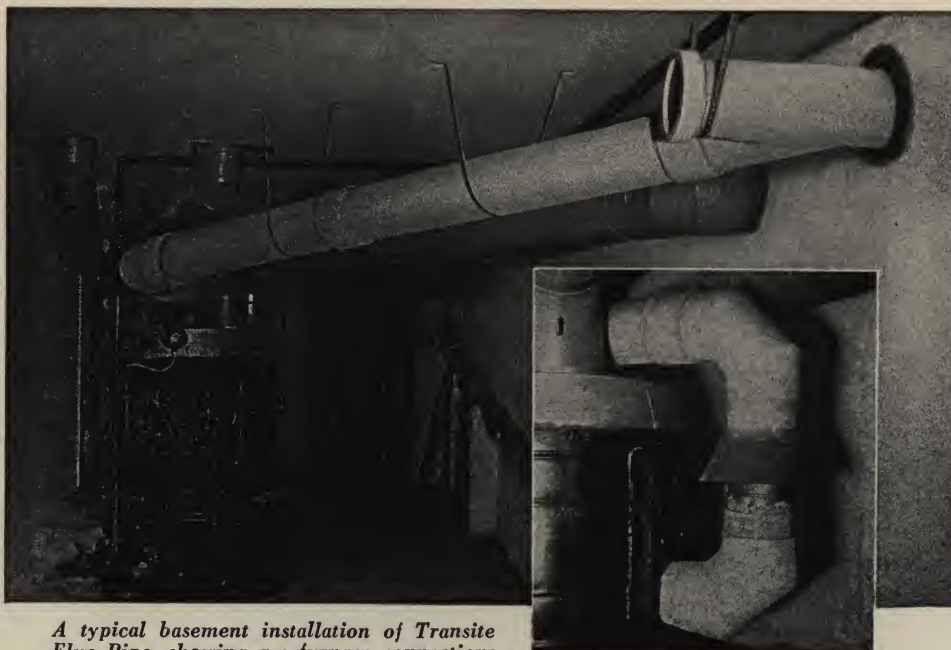
The oval pipe (Style A) is also made with an interior cross-section of 1⅝" x 8⅛". The outside narrow dimension of Style A is 2⅛" and the corresponding dimension of the coupling is 3⅛".

### *Fittings and Couplings:*

Round Transite Flue Pipe is tapered at both ends and all fittings have either tapered ends or tapered sockets so that any two pieces may be connected by use of the tapered coupling, or directly without couplings.

\* Reg. U. S. Pat. Off.





*A typical basement installation of Transite Flue Pipe, showing gas furnace connections*

In order to provide for the connection of field cut pipe a duplex coupling is available with one tapered outlet and one bell to receive the cut piece.

The ends of oval Transite Flue Pipe and fittings are cut square to receive couplings. One coupling is furnished cemented to each length of oval pipe. The fittings are also furnished with one or more couplings, cemented on at the factory.

The joints are formed with an oval coupling, which provides a space of  $\frac{3}{16}$ " for cementing. Joints for Style A pipe are similarly formed and a space of  $\frac{1}{4}$ " is provided for cementing.

The various types of round and oval fittings and couplings are illustrated on separate data sheets.

#### Joint Cement:

Transite Flue Pipe Cement is a ready-mixed material for use in all pipe joints and openings in brick and stonework through which pipe may pass. For tapered couplings, enough water is added to the cement to provide a thick creamy consistency; for duplex and oval couplings, the cement is used as a paste.

Transite Flue Pipe Cement air sets. The pipe need not be wet before application of the cement. Case hardening occurs in three to four hours; a  $\frac{1}{8}$ " joint reaches full strength in approximately 24 hours and a  $\frac{1}{4}$ " joint in about two to three days. The cement,

after attaining full strength, will hold its bond under all atmospheric conditions and through the entire range of flue gas temperatures for which the pipe is recommended. Furnished in various sized containers from 1 to 35 lb and must be ordered separately. The table gives approximate quantities per 100 joints.

Round Pipe Size, inches	Bell end of Duplex Coupling, lb		One end of Tapered Coupling, lb
	No. 1	No. 2	
3	53	64	9
4	76	91	13
5	92	109	15
6	105	127	18
7	152	183	27
8	172	205	30
10	210	252	37
12	300	350	49

	Pipe number	Inside dimensions, inches	One end of oval coupling, lb
Oval Flue Pipe	3	2¼ x 4¼	32
	4	2¼ x 6½	42
	5	2¼ x 9¾	72
	6	2¼ x 11¼	82
	A	1½ x 8½	52



**Approximate Weights of Round Transite Flue Pipe and Fittings \***

Standard Lengths: 3" to 7" pipe, 5 ft.; 8" to 12" pipe, 6½ ft. (With Socket Joint: 3" to 12" pipe, 13 ft.)

Pipe Size In.	Pipe, and 1 coupling, lb/ft	30° 45° 60° El., and 1 coupling, lb	90° El. and 1 coupling, lb.	Tees and 2 Couplings		Laterals, and 2 Couplings, lb	Tapered Couplings, lb	Flashing Couplings, lb	Deflection Couplings, lb	Duplex Couplings		End and Drip Caps, lb	Ventilator Top, lb	Cone† Tops with Pipe Leg, lb	Cone Tops without Pipe Leg, lb	Pipe with Socket Joint, lb/ft	Roof and Floor Fittings, lb/ft
				Short leg, lb	Long leg, lb					No. 1 lb	No. 2 lb						
3	3.8	3.9	4.6	6.7	8.1	10.5	1.4	5.7	1.9	1.8	2.1	1.0	7.6	6.1	.8	4.6	9.0
4	5.0	5.0	7.2	10.4	11.9	12.7	2.0	7.3	2.6	2.1	2.5	1.4	11.8	8.1	1.2	6.0	11.0
5	6.6	6.5	10.5	15.7	17.6	17.4	3.0	9.3	3.7	3.2	3.7	2.5	17.0	11.5	2.5	8.6	14.4
6	8.0	8.3	13.0	18.5	20.8	23.3	3.0	10.6	4.0	3.4	4.2	3.0	24.0	15.5	4.4	10.7	16.8
7	9.6	11.8	15.0	21.0	24.1	31.5	4.0	18.8	.....	5.3	7.6	3.3	30.0	19.2	6.0	14.1	22.6
8	10.7	17.1	20.4	27.7	31.2	46.0	6.6	21.0	.....	7.8	8.4	4.2	42.0	22.4	8.4	16.8	25.3
10	13.4	22.5	32.2	43.4	46.7	63.9	8.2	25.2	.....	9.5	10.2	5.4	59.0	28.5	11.0	28.0	29.9
12	18.4	36.0	57.0	70.0	74.6	95.5	12.0	38.2	.....	12.2	16.2	6.7	86.0	38.5	14.5	38.6	40.8

Weight of Reducers: Approximately 0.5 lb per inch of large diameter, e.g., 6" to 4" weights 3 lb.

\*The weights given are for individual fittings, including couplings where specified.

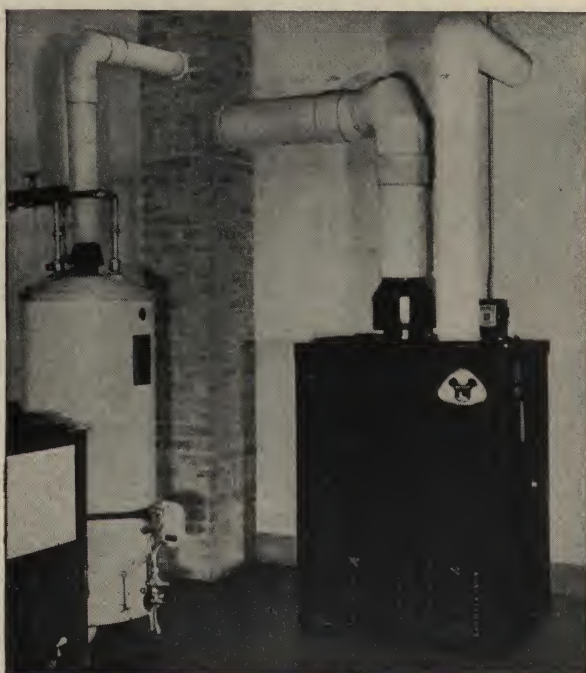
†Shipped unassembled.

**Approximate Weights of Oval Transite Flue Pipe and Fittings**

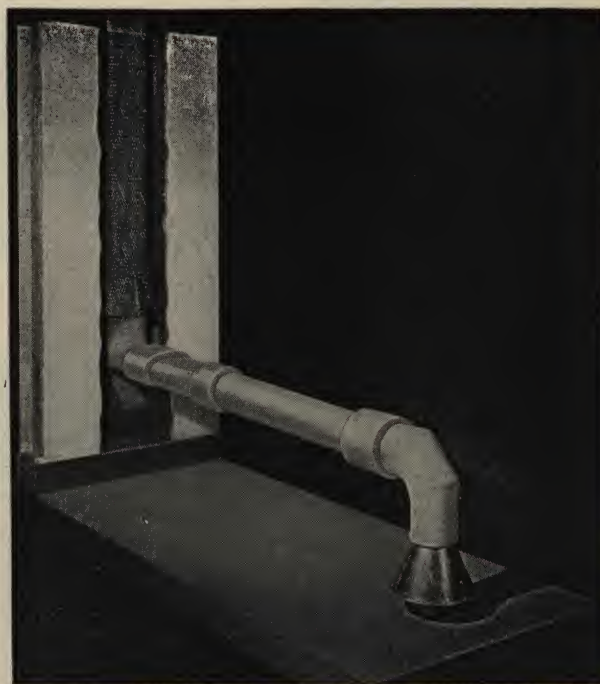
Pipe No.	Inside dimensions, inches	Pipe, and 1 Coupling		Ribbed Couplings, lb	45° Elbow† and 1 Coupling, lb	90° Elbow† and 1 Coupling, lb	Tees,† and 2 Couplings, lb	End and Drip Caps, lb	Lateral,† and 2 Couplings, lb	Reducer, and 1 Coupling, lb	Adapter,† and 1 Coupling, lb
		Std. L. ft	Wt. lb/ft								
3	2¼ x 4¼	5	2.5	1.1	3.5	3.5	4.5	1.2	5.8	3.5	3.5
4	2¼ x 6⅝	5	3.4	2.2	5.8	5.8	7.5	1.6	9.6	5.2	5.2
5	2¼ x 9¾	5	4.2	3.0	9.3	9.3	13.4	2.2	19.6	8.6	8.6
6	2¼ x 11¼	5	5.1	3.6	10.6	10.6	18.0	2.5	28.0	10.0	10.0
A	1⅝ x 8⅞	5	3.4	2.2	5.8	5.8	7.5	1.6	9.6	—	5.2

†Elbows and tees are supplied as either standard or flat fittings; laterals flat only. Standard tees are supplied with either oval or round branch outlet.

†Adaptors are supplied with oval or tapered couplings.



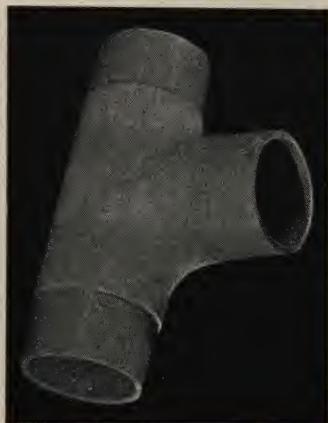
Gas-fired water heaters and boilers are neatly vented with Transite Flue Pipe



Transite Pipe erected to illustrate the connections used between a round heater vent and an oval wall flue



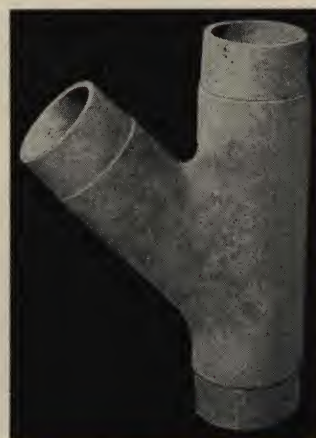
*Round Transite Flue Pipe, Typical Fittings and Couplings*



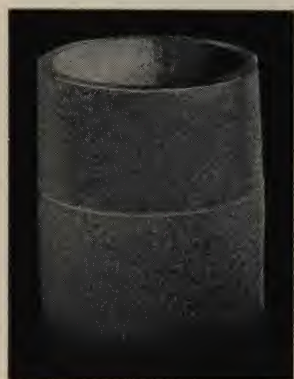
*Short-leg Tee*



*Long-leg Tee*



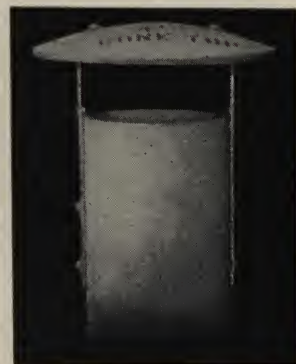
*Lateral*



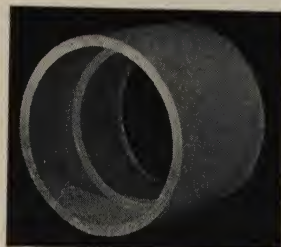
*Tapered Flue Pipe*



*Socket Joint Pipe for chimney liner*



*Cone Top*



*Duplex Coupling*



*Reducer*



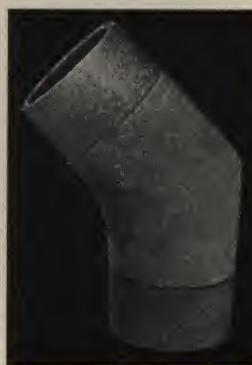
*Drip Cap*



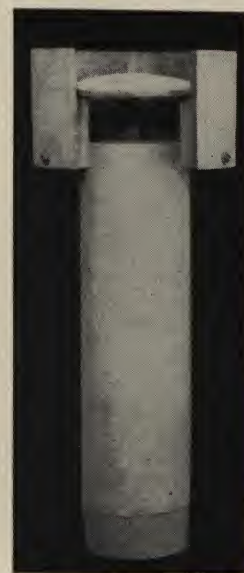
*Tapered Coupling*



*90 deg. Elbow*



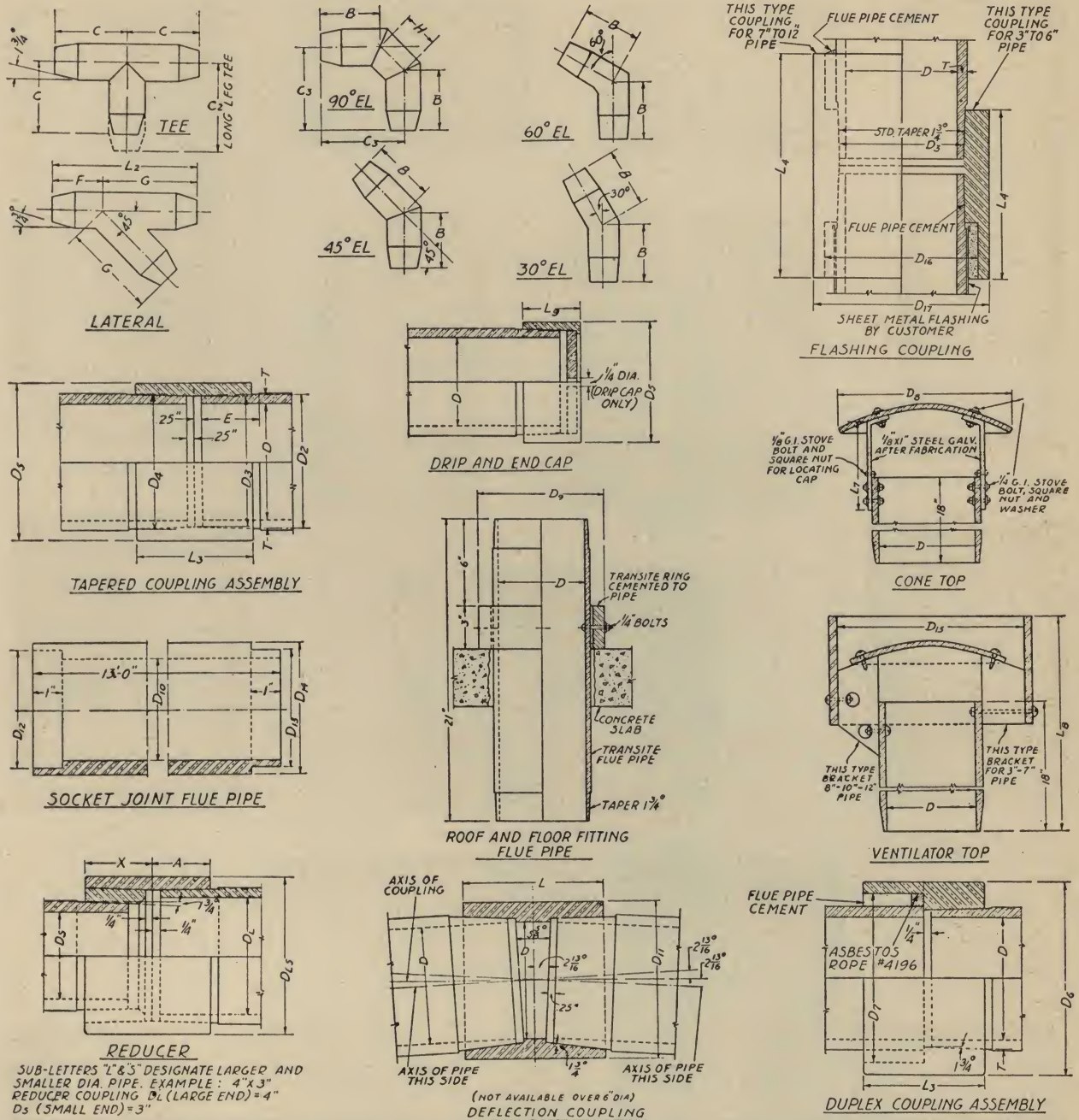
*45 deg. Elbow*



*Ventilator Top*



## Round Transite Flue Pipe, Fittings and Couplings



SUB-LETTERS "L" & "S" DESIGNATE LARGER AND SMALLER DIA. PIPE. EXAMPLE: 4" X 3" REDUCER COUPLING. DL (LARGE END) = 4" DS (SMALL END) = 3"

DIMENSIONS: ROUND TRANSITE FLUE PIPE, FITTINGS AND COUPLINGS (ALL DIMENSIONS ARE IN INCHES)

PIPE SIZE	A	B	C	C <sub>2</sub>	C <sub>3</sub>	D	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>	D <sub>8</sub>	D <sub>9</sub>	D <sub>10</sub>	D <sub>11</sub>	D <sub>12</sub>	D <sub>13</sub>	D <sub>14</sub>	D <sub>15</sub>	D <sub>16</sub>	D <sub>17</sub>	F	G	H	L	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>7</sub>	L <sub>8</sub>	L <sub>9</sub>	T	REDUCTION	X
3	1.75	—	—	—	—	3.00	3.64	3.53	3.62	4.40	4.99	4.19	5.60	5.70	3.00	4.42	3.48	3.40	3.88	6	4.50	5.30	—	—	—	4.25	—	3.50	5.00	8.10	20.6	2.50	.32	2.32	—
4	2.00	—	—	—	—	4.00	4.64	4.52	4.62	5.42	5.99	5.19	6.00	6.70	3.95	5.42	4.44	4.36	4.85	8	5.50	6.30	—	—	—	4.75	—	4.00	5.50	8.10	22.0	2.75	.32	2.32	2.82
5	2.00	—	—	—	—	5.00	5.70	5.58	5.68	6.56	7.13	6.25	9.60	7.80	5.00	6.46	5.55	5.47	6.02	10	6.56	7.44	—	—	—	4.75	—	4.00	5.50	8.10	23.0	2.75	.35	2.60	2.85
6	2.00	—	—	—	—	6.00	6.70	6.58	6.68	7.56	8.13	7.25	11.20	8.80	5.85	7.48	6.44	6.36	6.95	12	7.56	8.44	—	—	—	4.75	—	4.00	5.50	8.10	24.0	2.75	.35	2.60	3.10
7	2.50	6.30	8.50	18.50	11.45	7.00	7.60	7.65	7.78	8.78	9.43	8.43	14.40	9.82	7.00	—	7.65	7.57	8.22	14	8.66	9.66	6.50	16.5	7.0	—	23.00	5.00	10	15.01	25.0	3.25	.40	2.65	3.15
8	2.50	6.75	9.00	19.00	12.41	8.00	8.80	8.65	8.78	9.78	10.43	9.43	16.00	10.80	7.85	—	8.54	8.46	9.15	16	9.66	10.66	7.00	17.5	8.0	—	24.50	5.00	10	15.01	26.0	3.25	.40	3.15	3.15
10	2.50	7.25	11.00	20.00	14.32	10.00	10.80	10.65	10.78	11.78	12.43	11.43	20.00	12.70	10.00	—	10.89	10.81	11.70	20	11.66	12.66	7.50	20.5	10.0	—	28.00	5.00	10	15.01	28.0	3.25	.40	—	3.65
12	3.00	8.50	12.00	21.00	16.99	12.00	12.90	12.72	12.88	14.01	14.65	13.53	24.00	15.04	12.00	—	13.02	12.94	13.96	24	13.76	14.88	8.50	24.5	12.0	—	33.00	6.00	12	15.01	30.0	3.75	.45	—	3.70

## ROUND TRANSITE FLUE PIPE, FITTINGS AND COUPLINGS

August, 1950 (Cancelling sheet dated December, 1949)

BMT-412



*Oval Transite Flue Pipe, Fittings and Couplings*



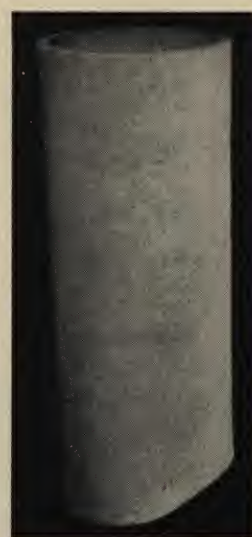
*Pipe & Coupling*



*Ribbed Coupling*



*Drip Cap*



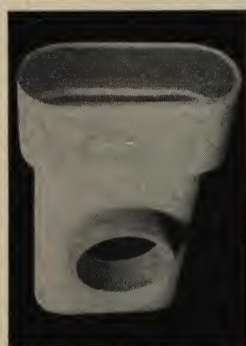
*Adaptor—Oval to Round*



*Tee—Oval Outlet*



*Reducer*



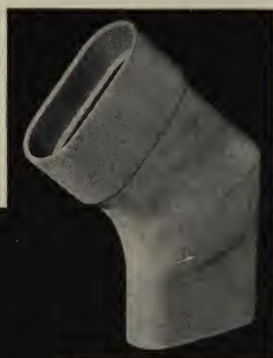
*Tee—Round Outlet*



*45 deg Elbow*



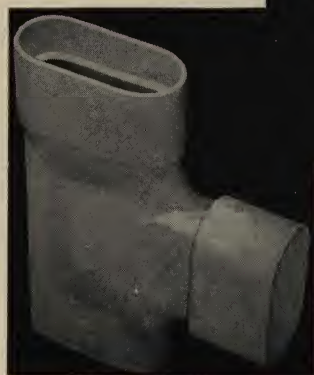
*90 deg Elbow*



*45 deg Elbow  
(Flat Oval)*



*90 deg Elbow  
(Flat Oval)*



*Flat Oval Tee*

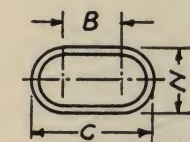
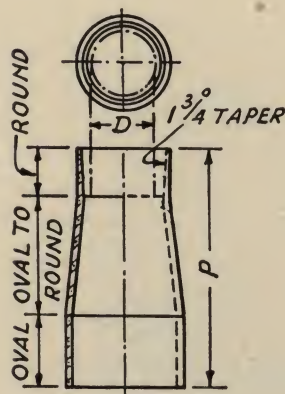
*The two illustrations directly above,  
and at the sides, are Flat Oval  
Fittings. They allow change of di-  
rection in the same plane*



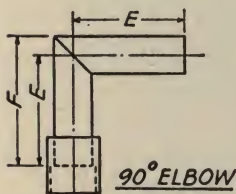
*Flat Oval Lateral*



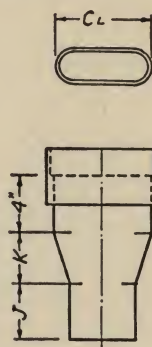
# Oval Transite Flue Pipe, Fittings and Couplings



ADAPTOR  
OVAL TO ROUND

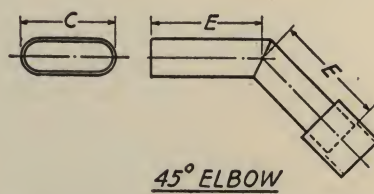


90° ELBOW

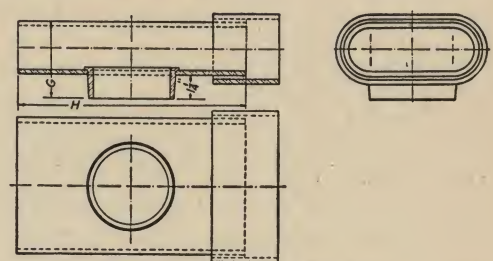


OVAL TO OVAL  
REDUCER

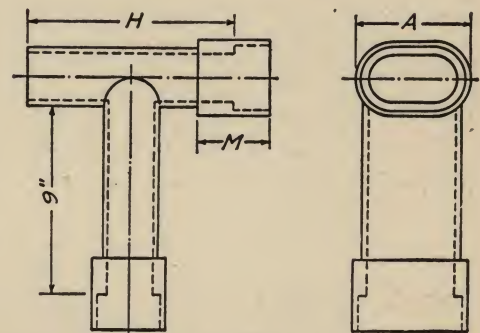
SUB LETTERS "L" AND "S" DESIGNATE  
LARGER AND SMALLER PIPE SIZE.



45° ELBOW

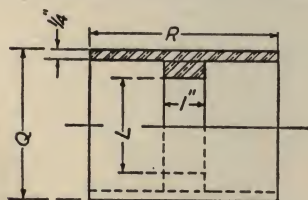


TEE - ROUND OUTLET

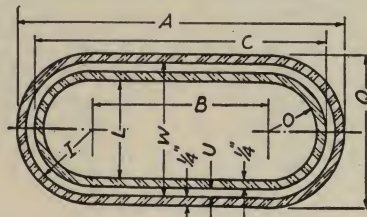


TEE - OVAL OUTLET

DIMENSIONS—OVAL FITTINGS AND COUPLINGS																				
PIPE NO.	INSIDE DIM. INS.	A INS.	B INS.	C INS.	D INS.	E INS.	F INS.	G INS.	H INS.	I INS.	J INS.	K INS.	L INS.	M INS.	N INS.	O INS.	P INS.	Q INS.	R INS.	U INS.
3	2 1/4 x 4 1/4	5.6	1.96	4.7	3.0	6.5	7.87	4.0	10.0	1.56	—	—	2.25	3.5	2.75	1.13	10.00	3.63	4.5	.19
4	2 1/4 x 6 5/8	7.9	4.31	7.1	4.0	8.0	9.37	4.0	12.0	1.56	3.5	3.51	2.25	3.5	2.75	1.13	14.25	3.63	4.5	.19
5	2 1/4 x 9 3/4	11.1	7.46	10.2	5.0	9.0	10.37	4.0	14.0	1.56	4.0	4.74	2.25	4.5	2.75	1.13	16.25	3.63	5.5	.19
6	2 1/4 x 11 1/4	12.6	9.01	11.8	6.0	10.0	11.37	4.0	16.0	1.56	4.0	2.31	2.25	4.5	2.75	1.13	18.25	3.63	5.5	.19
A	1 7/8 x 8 1/8	9.6	6.50	8.6	4.0	8.0	9.06	3.4	12.0	1.31	—	—	1.63	3.5	2.13	0.81	14.25	3.13	4.5	.25

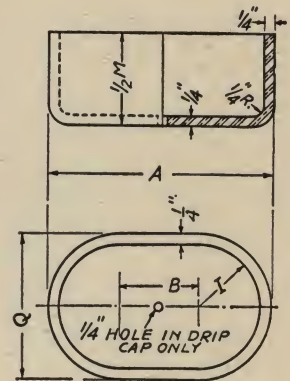


RIBBED COUPLING



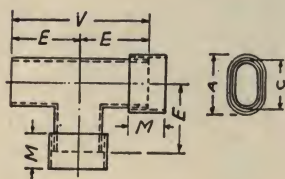
OVAL PIPE - CROSS SECTION - COUPLING

OVAL PIPE HAS COUPLING CEMENTED ONE END

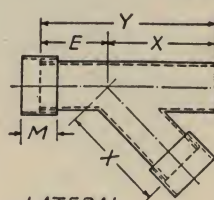


DRIP CAP

END CAP SIMILAR WITH NO HOLE

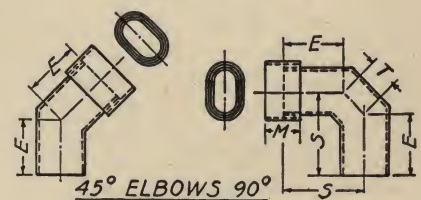


TEE



LATERAL

ADDITIONAL DIMENSIONS FLAT OVAL FITTINGS					
PIPE NO.	S INS.	T INS.	V INS.	X INS.	Y INS.
3	8.62	3	13	12	18.5
4	10.83	4	16	16	24.0
5	12.50	5	18	20	29.0
6	14.24	6	20	24	34.0
A	10.83	4	16	16	24.0



45° ELBOWS 90°



## Application of Transite Flue Pipe

Transite Flue Pipe is quickly assembled and readily installed. No special tools are required for any part of the assembly. It can be cut with a carpenter's saw or a hacksaw. Field cuts are ordinarily square and assembled with Duplex couplings. In some instances field tapering is desirable. For such purposes, a portable tapering tool is available.

The round pipe fits over all standard round outlets of gas heaters; an adaptor must be used if the outlet is oval. Its light weight makes the material easy to handle and support. Horizontal sections can be suspended with standard pipe hangers and vertical sections with the usual types of brackets.

The portion of the vent from the appliance to the point at which the pipe enters the stud framing is frequently

round pipe. Within the wall, between the studs, oval pipe is used. Round Transite Pipe with a cone or ventilator top is used for the upper portion of the flue which passes through the roof.

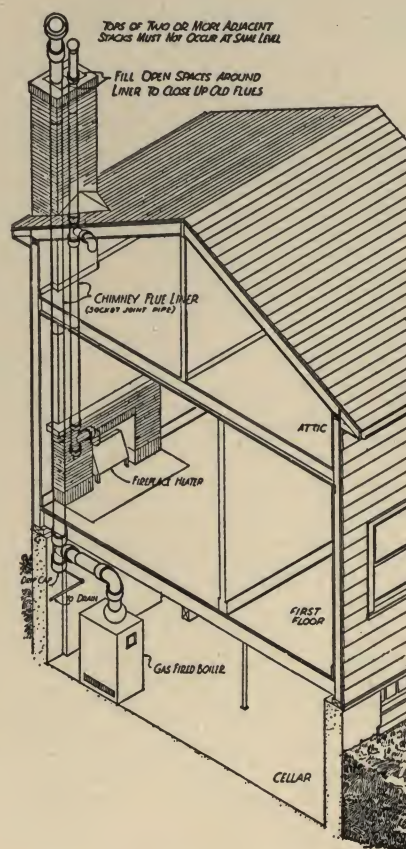
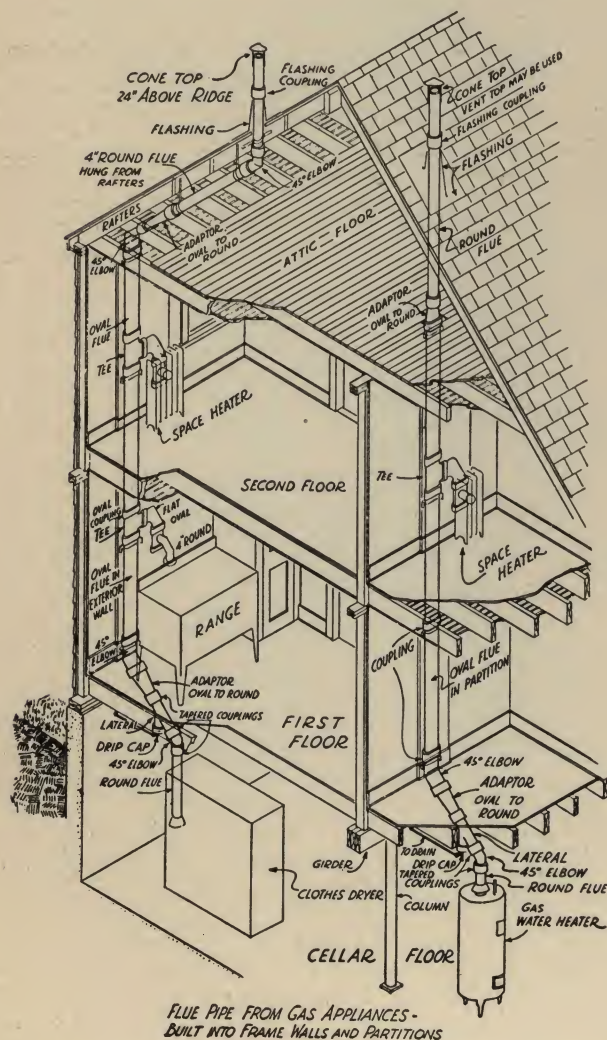
The transition from oval to round pipe may be readily accomplished by using a standard adaptor at the point where the space between the studs is adequate or where pipe is exposed in closets or attics.

When pipe is run between studs, metal lath should be used for the plaster base over the space, and all combustible materials should be cut back at least  $1\frac{1}{2}$ " from the outside surface of the pipe.

At the bottom of vertical runs of pipe a drip cap should be installed in the line by cementing it to one branch of a lateral or tee as shown in the drawings.

Wherever Transite Flue Pipe passes through a building wall or roof a flue thimble is required and the opening is properly flashed to prevent entrance of water or snow.

Complete application details for both round and oval flue pipe are given on separate data sheets.





## Transite Industrial Vent Pipe

### For Ducts, Vents and Stacks



*Transite Industrial Vent Pipe exhaust system in the plating room of the Chase Brass and Copper Company at Waterbury Conn. This installation of 20" duct is still in excellent condition after venting the corrosive acid fumes since 1935*

Transite Industrial Vent Pipe is specially designed to meet the many requirements involved in venting systems and has established a background of effective and economical service in this field. The many desirable characteristics of the material warrant its consideration in both natural-draft and forced-draft venting systems.

Emphasis on fire prevention and industrial health has developed a widespread recognition of the need for adequate ventilation. In practically every industrial building and laboratory, air conditioning or the venting of fumes, dusts and gases is considered essential.

Wherever groups of people gather indoors, some means of ventilation must be employed if comfort and efficiency are to be assured. In many industrial plants an exhaust system is required not only for the comfort and efficiency of workers; it is essential to the protection of life and property.

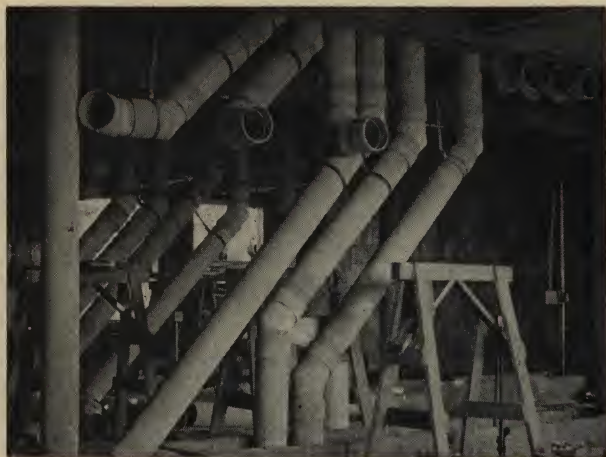
Recognition of the vital importance of venting has prompted regulatory bodies—city, state and federal—to draft safety codes which require the installation of an exhaust system wherever gases, fumes, mists or dusts

are developed. The New York State Department of Labor, in Bulletin 12 of the Industrial Code, lists processes and specifically indicates various industries and trades for which exhaust systems must be installed. In the National Board of Fire Underwriters' bulletin, "Ventilation and Air Conditioning Systems Employing Ducts," the following statement is made:

"Related to ventilation is the removal of dust, flying . . . generally for a two-fold purpose—(1) to maintain healthful working conditions, and (2) to mitigate the fire hazard by removing flammable products. In rooms in which . . . combustible flyings are given off, adequate ventilation should be provided to keep these products from accumulating in sufficient concentration to form explosive mixtures in the air."

Many industries, recognizing the importance of humidity and temperature control to the success of certain processes, consider the conditioning of air an essential requirement. Various processes involved in the manufacture of foods, drugs and textiles demand the control of atmospheric conditions.





*The original 6000 feet of Transite Industrial Vent Pipe are still in use after 10 years of venting laboratory gases in this large institution*

Whether the problem is one of ventilation only or whether the air supply itself must be treated, the selection of a satisfactory duct system is a matter of considerable importance. Transite Pipe offers the solution to many troublesome difficulties which formerly were encountered in this field.

### Characteristics

Composed of two durable materials, asbestos fibre and cement, Transite Pipe possesses unusual resistance to destructive agencies. The corrosive action set up by most of the gases encountered in service has little effect upon it.

The reinforcing character of the asbestos fibre in its composition and the heavy pressure under which the pipe is built up assure a dense material with unusual strength. Yet it is relatively light in weight. The polished steel mandrel on which the pipe is formed gives it a smooth inner surface which assures minimum resistance to the passage of air and gases, an important factor in economical operation.

The pipe is equally suited to both hot and cold venting. With the proper choice of couplings, Transite venting systems have satisfactorily withstood temperatures as high as 700 F.

Furthermore, the pipe is not affected by weather; no paint or other surface protection is required to preserve it. The material is an attractive grayish-white, but it can be painted as desired.

Since it has high electrical resistivity, Transite obviates the need for grounding, so essential with metal ducts when venting explosive dusts or fumes.

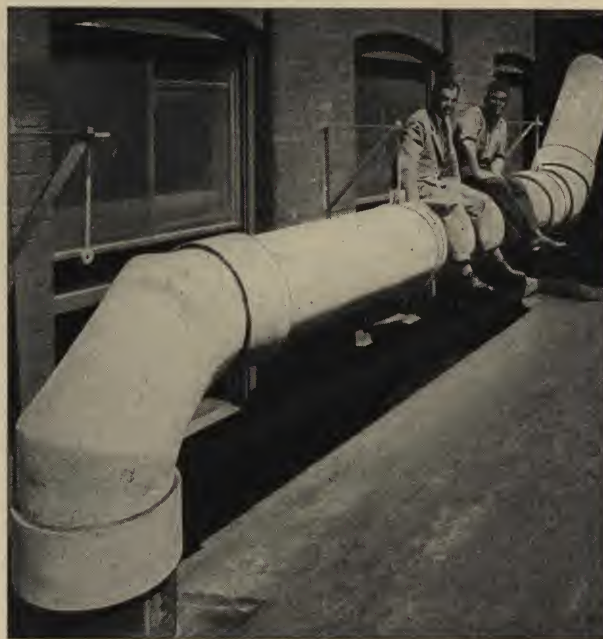
### Advantages

Because of the nature of the material and the method of manufacture, Transite Industrial Vent Pipe embodies characteristics required in an ideal duct material. Following are some of its advantages.

**Corrosion Resistance:** Resistance to corrosion is of particular importance in vents and stacks, where the products of combustion produce weak acids which are destructive to many materials. Similar conditions often prevail in systems used to vent the fumes of chemical processes. In some instances the outside of the stack is also subjected to corrosive fumes. The corrosion-resisting nature of Transite has enabled thousands of such installations of this material to provide, efficiently and economically, long service life.\*

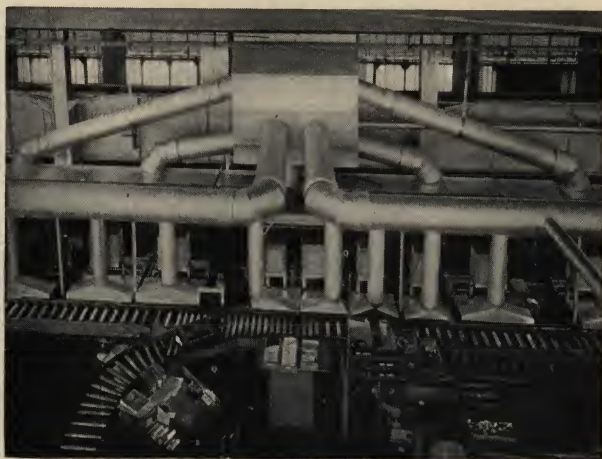
**Coefficient of Friction:** Especially designed for venting systems, Transite Industrial Vent Pipe offers little resistance to the flow of exhaust gases because of its smooth interior surface. Its low coefficient of friction makes the pipe an ideal duct material to convey air, gas and non-abrasive materials, under positive or negative pressure, with a minimum of power consumption. This characteristic has important significance in pneumatic conveyor and air-conditioning systems.

\* There are certain acid conditions where additional corrosion resistance may be provided by the use of impregnations and coatings. Where unusual conditions are encountered, consult Johns-Manville, giving full details.



*Carrying corrosive acid fumes from the fans to a large outdoor Transite stack, this 20" line of Transite Industrial Vent Pipe has been in service over 12 years*





*The Transite Industrial Vent Pipe System conveying a variety of acid and alkali process fumes in this large modern industrial plant is still in perfect condition and has been free of maintenance since its installation in 1938*

**Thermal Properties:** Transite Pipe has relatively low heat conductivity which, in the case of stacks and vents, retards rapid drop in flue gas temperatures during passage through the flue. Consequently, through the use of this material, draft conditions are improved and condensation is reduced.

High temperature-resistance up to 700 F makes Transite an ideal flue or vent pipe for a wide range of service. In cases where the temperature in the pipe will exceed 150 F, Simplex Couplings are not used. Instead, depending upon the service, one of the other types is employed.

**Economy:** The light-weight, convenient lengths and easy assembly of Transite Industrial Vent Pipe permit important installation economies. No special experience is required to join the pipe rapidly and easily with simple equipment. Suspended lines of Transite Pipe require only a minimum number of supports and impose the least weight, consistent with strength, on the structure. Lighter foundations, also, may often be employed for supporting Transite Pipe stacks.

**Assembly-Features:** Transite Industrial Vent Pipe may be readily cut in the field with a carpenter's saw. No complicated equipment is required for the installation of this material.

An adequate variety of Industrial Vent Pipe fittings is available to provide maximum flexibility in the design of the venting system. Through the use of proper fitting combinations, erection problems can be greatly simplified. This flexibility is particularly important in the design of systems for existing structures.

Where conditions do not permit the use of stock fittings, special Transite fittings of almost any shape

can be made to meet the individual requirements. When such special fittings are necessary, drawings showing conditions and requirements should be submitted to the local Johns-Manville representative.

To utilize fully the possible combination of stock fittings in a complicated vent system, a Johns-Manville engineer is available to assist in the choice and layout of Transite fittings and pipe.

### Uses

Transite is exceptionally serviceable in ducts, vents, stacks and ventilators where corrosive gases are encountered. The use of Transite Pipe is equally advantageous in the construction of exhaust systems for the removal of dangerous fumes and dusts.

Typical operations which require the use of a venting system include those that involve the grinding and polishing of glass, stone or metal; heating and melting operations, especially those involving metal compounds; operations which create corrosive fumes and mists, as in the manufacture of chemicals; and processes where explosive dusts are formed, as in the handling of flour or coal. Long enumerations of manufacturing processes which require venting systems are listed in publications of various regulatory bodies.

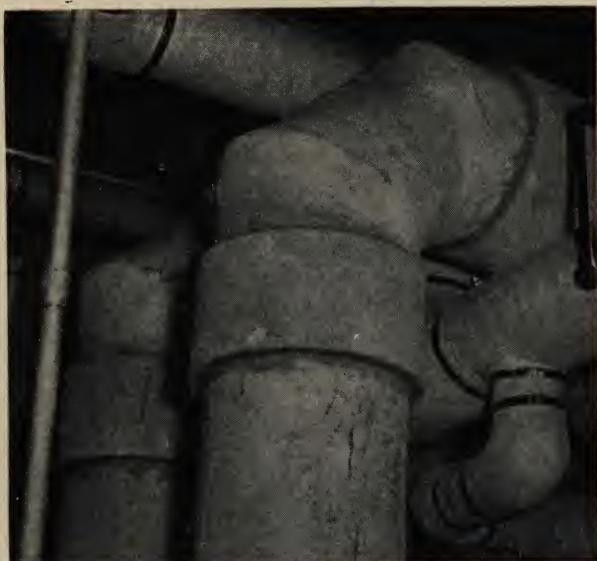
In most of these locations Transite Pipe will prove economical and satisfactory. Because of its inherent advantages, this material may be utilized for almost any type of venting system, both indoors and outside.

**Ducts:** The duct of a venting system consists of all the pipe, together with fittings, from the point where the gases or dusts are drawn off to the base of the stack.



*After 10 years, this 30" Transite Industrial Vent Pipe installation is still used to vent corrosive gases from the sludge-drying chamber of a sewage disposal plant*





*Transite Industrial Vent Pipe used as a breeching for a gas-fired boiler*

In air-conditioning and pneumatic conveying, practically the entire system, aside from the mechanical equipment, is made up of ducts.

In venting, the exhaust products may be drawn into the duct by means of natural draft or with blowers. Transite Pipe is equally efficient with both.

**Stacks:** That portion of the venting system designed to convey the exhaust gases from the duct line to the outside atmosphere must generally withstand severe service. In addition to the action of gases and condensate, it must withstand the disintegrating forces of the elements. Many years of service under such conditions have proved the durability of Transite.

Cone tops are often installed at the top of stacks or flues to protect the outlet from wind, rain and snow. Such a fitting is usually assembled as an integral part of the venting system.

### Description

Transite Industrial Vent Pipe is furnished in standard pipe sizes of 3" through 36". It is supplied in 10 or 13-ft lengths according to the inside diameter.

Standard lengths, inside and outside diameters, wall thicknesses and weights of Transite Industrial Vent Pipe are listed in the following table.

The pipe is furnished regularly with plain, unmachined ends for use with Transite sleeve, heavy sleeve or ribbed couplings. Pipe ends may be ordered machined for use with Simplex or split-and-bolted couplings. In pipe sizes of 3" through 12", the ends may

### Dimensions and Weights

Inside Diameter, inches	Length, feet	Outside Diameter, inches	Wall Thickness, inches	Weight, lb per foot
3	10	3.64	.32	3.5
4	10	4.64	.32	4.5
5	10	5.70	.35	5.9
6	10	6.70	.35	7.3
7	10	7.80	.40	8.6
8	13	8.80	.40	11.2
10	13	10.80	.40	13.9
12	13	12.90	.45	18.4
14	13	14.90	.45	18.8
16	13	17.00	.50	23.6
18	13	19.00	.50	26.6
20	13	21.10	.55	32.6
24	13	25.20	.60	42.7
30	13	31.34	.67	59.4
36	13	37.50	.75	79.5

be ordered tapered for use with tapered couplings. All orders for pipe should specify the type of coupling to be used.

All couplings must be ordered separately, with the exception of tapered and Simplex couplings. One such coupling is furnished with each section of pipe.

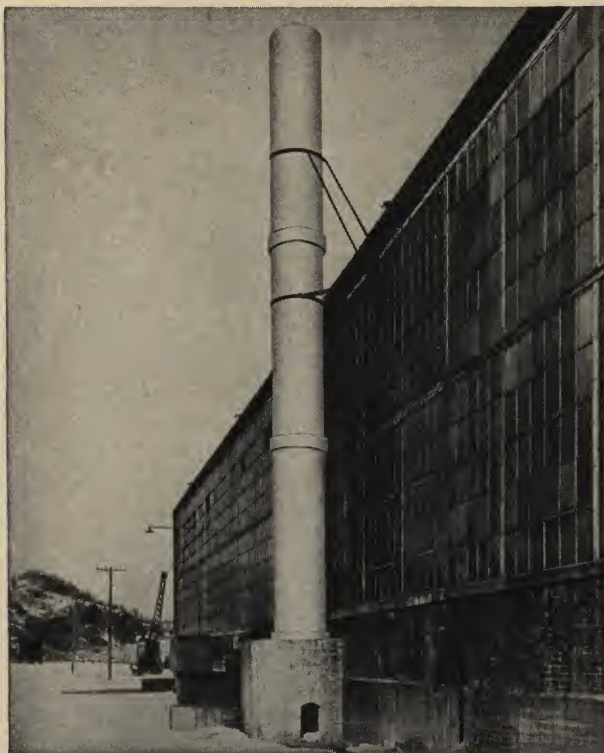
The split-and-bolted coupling is hand-fitted to a pipe end. Then the coupling and pipe end are drilled for bolts and marked to assure correct matching when assembling on the job. Bolts, bolt-head putty and Ferro Compound are included.

J-M Flue Pipe Cement, special joint cements, joint compounds and asbestos yarn, when required in the assembly of the coupling, must be ordered separately.



*A special type of fitting was manufactured to accommodate the registers in this exhaust system*





*Installed over 15 years ago, this Transite Industrial Vent Pipe stack is still used to exhaust the corrosive fumes from a metal-working plant*

### **Couplings, Fittings and Accessories**

The wide variety of standard fittings permits maximum flexibility in the design of duct or venting systems. If unusual conditions, however, demand the use of a special fitting, such pieces can usually be furnished upon receipt of drawings indicating the conditions to be met. A summary of the standard fittings appears below. Full details are on other data sheets.

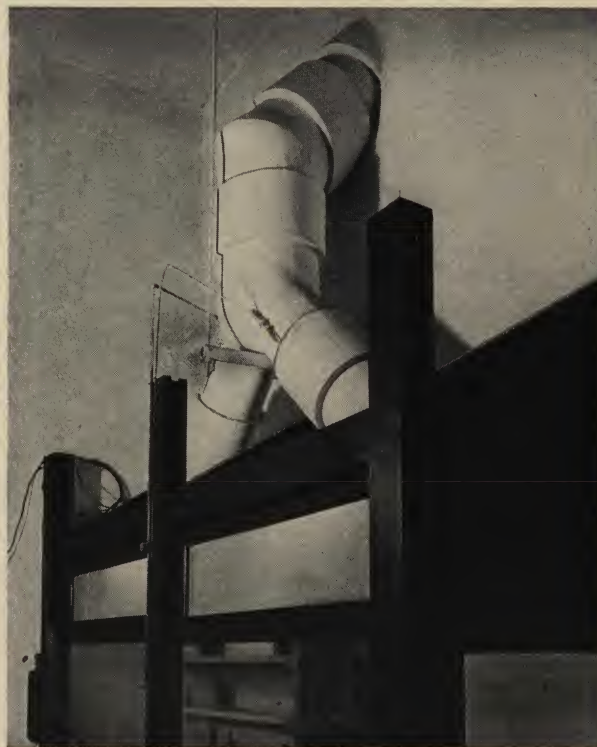
**Couplings:** For joining unmachined pipe ends, sleeve, heavy sleeve and ribbed couplings are available. The sleeve coupling is simply a Transite sleeve which fits over the joint and is caulked in place. The heavy sleeve coupling is utilized in lines where high flexural strength is required, as when the pipe acts as a continuous beam. The ribbed coupling is similar to the sleeve coupling but possesses a rib on the inside surface which facilitates the assembly of the joint. During the assembly operation these couplings are yarned with J-M No. 4196 Asbestos Rope and caulked with J-M Flue Pipe Cement, J-M Chemstone Cement or a sulphur-base compound. These couplings are available in all Transite Pipe sizes and are suitable for positive or negative internal air pressures up to 16" of water.

Tapered, duplex and reducer couplings are available in pipe sizes of 3" through 12". The tapered coupling

is used to join tapered pipe ends. The duplex coupling is used to join a tapered and unmachined pipe end and is ordinarily employed in the assembly of a cut section of pipe. The reducer coupling permits reductions or increases up to 2" in the size of tapered pipe diameters. Tapered couplings, duplex couplings and reducer couplings are suitable for positive or negative internal air pressures up to 16" of water.

The Simplex Coupling consists of a Transite sleeve which is drawn over two rubber rings during the assembly operation. The service limits of this coupling are: negative air pressure, 30" of water; positive air pressure, 150" of water; temperature, 150 F. When the Simplex Coupling is used, connections to any fittings are made with sleeve couplings poured with a sulphur-base compound.

Split-and-bolted couplings are used to join pipe of 16" through 36" diameter and high flexural strength is required in the assembly. This coupling consists of a split and drilled Transite sleeve which is bolted during assembly to the machined and drilled pipe ends. The coupling is suitable for positive or negative air pressures up to 16" of water, but it cannot be used with the fittings described in following paragraphs as it requires a machined surface.



*Venting a fume hood with Transite Industrial Vent Pipe. The wide variety of fittings available simplifies installation in existing structures*



**Fittings:** Fittings consist of tees, crosses, laterals, ells, drip and end caps, reducers, cone tops, dampers and flexible fan connections.

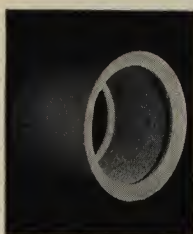
Tees, crosses and laterals are available with regular or reducing legs. Both 45 deg and 90 deg ells are standard. These fittings, together with caps, normal reducers and tops, are furnished with tapered ends in pipe sizes of 3" through 12"; they are furnished with unmachined ends in pipe sizes of 3" through 36". The pertinent fittings are suitable for negative air pressures up to 30" of water and positive air pressures up to 150" of water.

Dampers are available with metal or moulded asbestos trunnions. The flexible fan connections are made of impregnated asbestos cloth and are furnished to fit the dimensions indicated on the order.

**Accessories:** J-M Transite Flue Pipe Cement or Chemstone Cement is used for making up joints with all except Simplex and split-and-bolted couplings. The cements are furnished in suitable containers.

J-M Asbestos Rope, No. 4196 is used in the assembly of sleeve, heavy sleeve, ribbed and duplex couplings. It is furnished in 10, 25 and 50-lb coils in thicknesses of  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ " and  $\frac{7}{8}$ ".

### Transite Industrial Vent Pipe Couplings and Fittings



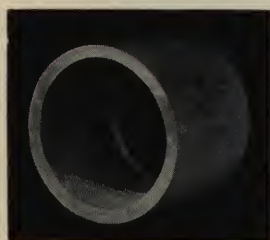
*Simplex Coupling*



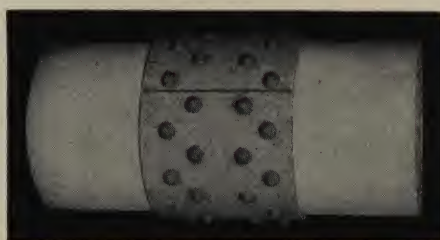
*Duplex Coupling*



*Sleeve Coupling*



*Tapered Coupling*



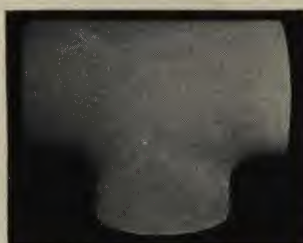
*Split-and-Bolted Coupling*



*Lateral*



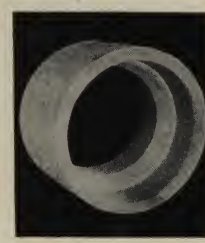
*Cone Top*



*Tee*



*45 deg Ell*



*Reducer Coupling*



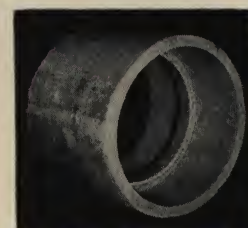
*End Cap*



*Normal Reducer*



*90 deg Ell*



*Ribbed Coupling*



## Transite Pressure Pipe



*Transite Pressure Pipe, offering unusual savings in the cost of installation, operation and maintenance, is the pipe to use in water works construction*

Few things are more essential to the life of a community than an abundance of pure water. This necessitates an adequate system of pipes for the transportation and distribution of a constant supply. Pressures and rate of flow must be maintained at all times for normal peak loads as well as for fire fighting.

The choice of pipe is properly a matter of engineering economics. A pipe line has certain basic functions to perform and the type of pipe material which renders these services at the lowest cost per year, taking into account installation, operating, and maintenance charges, is the one that should be used. This means that the pipe material should not only be most efficient for the first few years of service but throughout the period over which its useful life is apportioned.

Transite\* offers a combination of economic advantages not found in any other pipe material, making it the logical pipe to use in water-works construction. It offers unusual savings in the cost of installation, operation, and maintenance. Among the outstanding advantages contributing to these economies are:

1. A high flow coefficient, owing to Transite's smooth interior surface, which results in high carrying capacities, greater pressures and reduced pumping costs.

2. Freedom from tuberculation, so that the original high flow characteristics are maintained and pumping economies continued.

3. Immunity from electrolysis, permitting the pipe to be used with complete freedom from this destructive process.

4. Corrosion resistance, assuring maximum life with minimum maintenance even where soil conditions are severe or the water corrosive.

5. Light weight, permitting easy handling of the pipe, and resulting in installation savings.

6. Tight, flexible joints, quickly assembled and effecting drastic economies in laying costs and reduction in joint leakage, are assured by Simplex Couplings.

7. Uniform high strength, checked at the factory and assured by Transite's inherent durability.

8. Adaptability to standard waterworks practice, permitting the pipe to be installed in keeping with accepted waterworks methods. Pipe may be drilled and tapped, connected to fittings, and cut in for connections, using standard operations and equipment.

Thousands of Transite Pipe installations are in service today in municipalities throughout the United States. These installations are establishing a high degree of efficiency under a wide variety of conditions. At many of these locations waters are highly tuberculating and soil conditions are notably severe. Installations are found in acid, alkaline, cinder and salt marsh fills. Industry has used many thousands of miles of Transite Pipe for water supply and fire lines, and

\* Reg. U. S. Pat. Off.

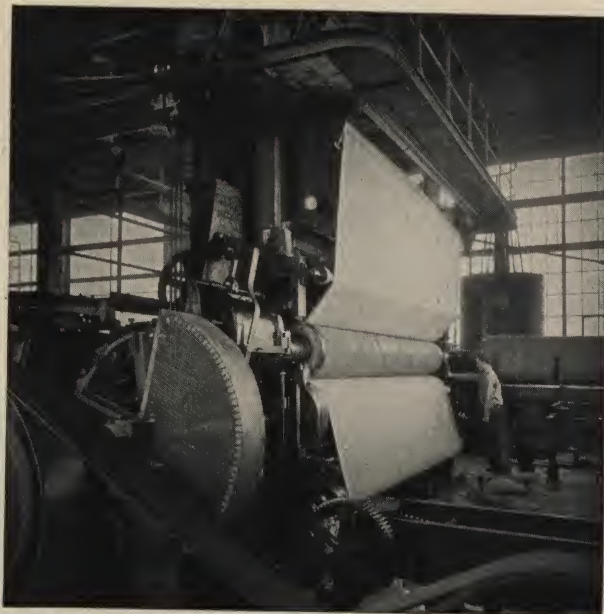


has used it extensively for process lines. This ever-increasing demand for Transite Pipe is fulfilled by four large Johns-Manville factories located at convenient points in the United States, and one in Canada.

### Description of Materials

Transite Pressure Pipe is manufactured from asbestos, silica and cement which have been converted during manufacture into a dense, homogeneous material possessing unusual strength and corrosion resistance. The asbestos fiber is thoroughly mixed with the cement and serves as a reinforcement. The tensile strength of these fibers runs as high as 400,000 lb per sq in.

Every step in the manufacture of Transite Pipe is controlled and designed to add permanence and efficiency to the finished pipe. During manufacture, a film of cement and reinforcing fibers is fed to a revolving steel mandrel upon which the pipe is built. This mandrel possesses a polished finish which imparts to the pipe its smooth interior surface. As the mandrel revolves the asbestos-cement is built up to the required wall thickness. Heavy hydraulic pressure rolls



*Transite Pipe is built up on a polished steel mandrel and compressed by heavy hydraulic pressure rolls*

exert tremendous pressures against the pipe as it is being formed and compresses the mixture into a tough, dense, homogeneous structure of unusual strength and uniformity.

Following this step of manufacture, the pipe is inspected and calipered by trained inspectors and then subjected to a series of operations designed to give additional strength and permanence.

In the finishing department the ends are trimmed and machined to furnish a smooth exterior surface. This assures proper seating of the rubber ring and contributes to the efficiency of the joint.

The Simplex Coupling used for assembling Transite Pipe consists of a Transite sleeve and two rubber rings which are tightly compressed between the ends of the pipe and the interior of the coupling. The sleeve affords a joint having the same corrosion-resisting qualities as the pipe itself. The interior surface and ends have been machined to provide the most efficient compression of the rubber rings. A coupling puller is used to pull the coupling over the end of the pipe. During this operation the rubber rings are compressed and rolled into their final position.

The rubber rings used in the Simplex Coupling embody all the improvements which have marked the science of rubber compounding over a long period of years. The most advanced technique of rubber manufacturing is applied in the preparation of these rings. When kept damp, cool, and protected from light, rubber is in its most favorable state of preservation. This



*Simplex Couplings with sleeve cut to show how rubber rings are compressed between sleeve and pipe: (1) start of operation; (2) sleeve pulled over one ring; (3) final position, sleeve centered over joint*



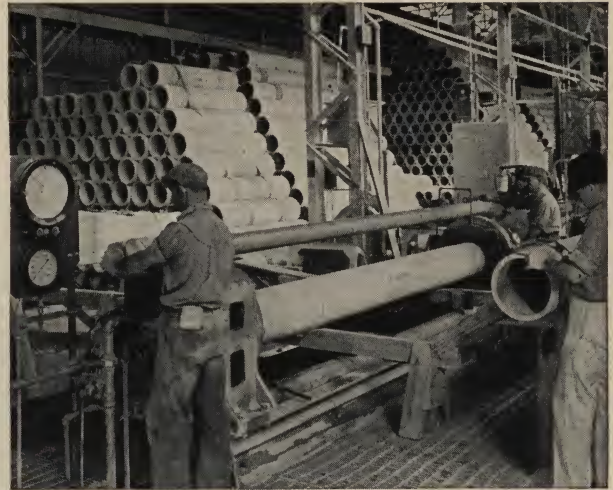
fact has been borne out by actual experience with rubber gaskets removed from service after many years. Such gaskets show a commendable state of preservation and retain practically all of their original elastic properties. One example of the long life which may be expected of rubber is a gasket removed from a Brooklyn, New York, water main which, after 69 years service, is in a fine state of preservation and continues to retain its elasticity. The tremendous progress achieved in the compounding of rubber within the last decade or two has further contributed to the already long established life of rubber as a sealing agent.

Classes, dimensions, approximate weights, etc., of Transite Pressure Pipe are given in tabular form on a following data sheet.

#### *Inspection and Tests:*

Before leaving the factory every length of pipe, coupling, and rubber ring is tested and inspected to assure that it will later perform with satisfaction. A staff of skilled technicians have, as their sole function, the checking of each pipe, coupling and ring to make sure that each meets rigid factory requirements.

Each length of standard pipe is accurately calipered and then tested in a hydrostatic testing machine to three and one-half times its specified working pressure. In sizes up to 3" the resistance to flexural stresses due to earth loads and street traffic may be an important consideration. The pipe, in these sizes is, therefore, subjected to a beam test. Each length is subjected to a



*Each length of pipe is accurately calipered and then tested in a hydrostatic testing machine*

third-point loading test, bent, held in that position, and then released. Standard couplings are also carefully calipered, their wall thicknesses gauged, and then subjected to a hydrostatic test of three and one-half times rated capacity in the same manner as that used for each of the standard pipe sections.

Before shipment, rubber rings are individually stretched to twice their diameter and while in this position minutely examined to assure sound condition.

These tests assure delivery of pipe and couplings which have successfully withstood tests in excess of conditions normally encountered in actual service.



*Hundreds of Transite Pipe installations are in service today in municipalities throughout the United States*



## Advantages of Transite Pressure Pipe

As previously mentioned, the most nearly ideal pipe material is the one which will cost the least per year of useful life, considering installation, operation and maintenance costs. Any intelligent determination of the cost of a pipe line must evaluate all three of these factors. Since Transite Pipe can generally effect substantial savings in the three costs involved, the most important of these economies are classified under the headings Installation, Operation, and Maintenance.

### Installation:

Light weight and speed of assembly make Transite Pipe an economic material to install. Savings start at the freight siding. More footage may be carried per truck-load; fewer men are required for handling. In diameters up to 16-inch Class 150, unloading from the truck, lowering into the trench, and aligning the pipe may be performed without the use of mechanical equipment other than ropes. Two men can easily carry a standard 13-foot length of 8-inch Class 150 Transite Pipe by hand. As a result, fewer man-hours are required for handling and laying.

The Simplex Coupling can be rapidly assembled without the use of skilled labor. Time of assembly is decreased and offers further economies. The coupling



*The Simplex Coupling can be easily assembled without the use of skilled labor and assures tight joints*

requires no heating equipment and can be assembled under practically any trench conditions. Its flexibility permits the line to be laid along curves, often without the need of fittings. Where fittings are required, connections are made according to standard water works practice. Transite Pipe can be connected to bell fittings using lead or sulphur-base compounds in accordance with usual practice. Adaptors enable Transite to be joined to existing pipe lines.

One of the many practical features of Transite Pressure Pipe is the ease with which it may be tapped for service connections. Proof of this is evident in the hundreds of thousands of corporation stops which, over the years, have been inserted in Transite water mains. Year after year, these installations continue to serve their communities with efficiency and economy. Transite Pipe can be tapped wet or dry; standard tapping machines are used. The special asbestos-cement composition which gives Transite its toughness and durability also provides excellent threading properties. The threads are sharp, clean and strong. Service connections are tight and lasting. Transite can be cut and machined on the job using standard asbestos-cement pipe tools available for the purpose. Pipe can also be cut using an ordinary carpenter's hand-saw.

Because of its light weight it is frequently possible to assemble pieces of Transite Pipe and fittings at one central point where all joints are poured. The completed units may then be carried to, and lowered into the trench at the desired locations. This procedure



*Transite Pipe can be tapped quickly and easily with standard tapping tools. No special operations are required*



permits centralization of pouring equipment and facilitates uninterrupted installation.

Since Transite Pipe can be quickly aligned and assembled, the speed of laying is generally limited only by the speed at which the trench can be opened. While rates of laying will depend upon local conditions, the pipe can nearly always be installed at a substantial reduction in time, labor, and expense.

### **Operation:**

Technically, carrying capacity may be regarded as the amount of water which will flow through a unit length of pipe of a given diameter in a specific period of time, for a given loss of pressure head. Practically, high carrying capacity is best measured by the ability of a pipe line to reduce pumping costs to a minimum and to maintain maximum pressures through-



*Since Transite Pipe can be quickly aligned and assembled, the speed of laying is generally limited only by the speed at which the trench can be opened*

out the line year after year without reduction in efficiency. It is not sufficient that a pipe line shall remain structurally intact after many years' service—it is necessary that it shall function with unreduced efficiency throughout its entire life.

**Tuberculation and Flow Coefficient:** One of the major problems in the water works industry today is the progressive reduction of carrying capacity of pipe due to tuberculation. Tuberculation, marked by the growth of nodules or "tubercles" which grow on and tenaciously cling to the interior pipe surface, impedes the passage of water and at the same time cuts down on the effective cross-section of the pipe line.

All other factors being equal, the relative carrying capacities of two or more pipes may best be designated by their flow coefficients. Perhaps the most commonly used coefficient employed in water works practice is that known as the Williams and Hazen flow coefficient, represented by the letter "C." The value of C for any given pipe depends upon the inside sur-



*Connections to fittings may be made at one central point and carried to the trench, thus facilitating uninterrupted installation by centralization of equipment*

face of that pipe. If the surface is rough and impedes the passage of water the coefficient is low. Another pipe of the same diameter with a smooth interior surface offering little resistance to the flow of water will have a high flow coefficient and a correspondingly high carrying capacity.

To overcome the effects of tuberculation which brings about a constant reduction in the value of C, engineers frequently allow for this reduction by specifying a larger diameter pipe than would otherwise be necessary. This is not a remedy but only a temporary expedient. As tuberculation progresses and the flow characteristics become worse, pressures throughout transmission and distribution lines will be cut down unless pumping rates are increased. In gravity systems pressures cannot generally be compensated for by increased pumping. To enable the engineer to choose a value of C which may be embodied in water works design, Williams and Hazen have established tables giving coefficients for various sizes of pipe. These values fall off progressively with the number of years service.



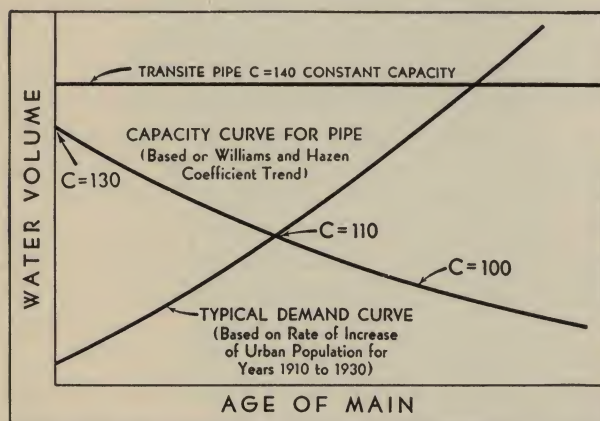
*The flexibility of Simplex Couplings permits laying the pipe around gradual curves without special fittings*





*The high flow coefficient of Transite Pipe, which can never be reduced by tuberculation, offers substantial economies in pumping costs*

For instance, while new 6" pipe is assumed to have a value of  $C = 130$  under average conditions, the value after four years is reduced to 120. After fifteen years the value of  $C$  is 100 and after thirty years the coefficient becomes 80—a decrease in carrying capacity of 38 percent. These tables suggest that transmission and distribution systems be designed not on the basis



*Showing the approximate reduction in delivery capacity, based upon the Williams and Hazen trend, caused by tuberculation when the pumping pressure remains constant*

of the initial condition of pipe, but on the basis of coefficients effective over the useful life of the pipe.

N. E. W. W. A. Report: A total of 473 field tests were made on existing systems in 19 different cities by the New England Water Works Association Committee to determine the trend of flow coefficients for existing water lines. After thorough investigation this committee indicated that the actual loss in carrying capacity exceeded that estimated and published by Williams and Hazen.

For example, starting from a value of  $C = 130$  for new pipe, the committee discovered that a value of  $C = 80$  was reached after only eight years' service, instead of 30 years as indicated by the Williams and

Hazen tables. At the end of thirty years the flow coefficient was found to be  $C = 45$ , or 43 percent less than that predicted by Williams and Hazen.

The following statement from the conclusion of the committee's report summarizes the conditions observed. "Data furnished to the committee indicate that the average rate of capacity is, in the majority of cities, and particularly for mains less than 16 inches in diameter, substantially greater than the rate indicated in the Williams and Hazen tables for average soft, unfiltered water." This report indicates the extent to which tuberculation seriously impedes the useful life and efficiency of water pipe lines subject to this type of corrosion.

**Economics Offered by Transite Pipe:** The smooth interior surface of Transite Pipe offers minimum resistance to the flow of water. Its original coefficient,  $C = 140$ , is unusually high. The important point, however, is that even after years of service Transite Pipe's high initial flow carrying capacity can never be reduced by tuberculation. In a test conducted by the Pitometer Company on an actual installation this organization reported—"From a study of data we believe that an average coefficient of  $C = 145$  is very nearly correct for this pipe." Other investigations based on actual installations verify these findings.



*Permanence was essential for the 10 miles of Transite Pipe in the highly corrosive soil at the New York Fair, which was finally used as a public park*





*Speed of assembly reduces the time trenches must be open, thus minimizing congestion and hindrance to business*

Since Transite gives definite assurance against loss of capacity due to tuberculation, calculations regarding rates of flow, pressures, and pumping cost need not make allowances for changes effected by length of service.

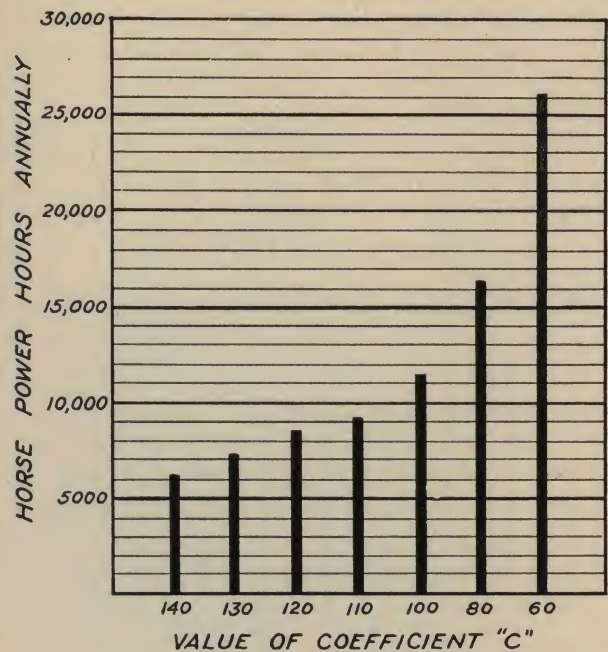
As an example showing how a high flow coefficient will offer substantial economies in pumping costs, consider two 12-inch pipe lines, each 1000 feet long, but one made of Transite having a Williams and Hazen  $C = 140$ , and the other having  $C$  estimated at 100 ( $C = 100$  is frequently assumed by engineers where the line is to be in service over an extended number of years). Assume delivery at the rate of 1000 gallons per minute.

With  $C = 140$ , 0.413 kilowatts will be required to overcome friction loss for 1000 feet of pipe. Where  $C = 100$ , 0.756 kilowatts will be required, or an increase of 83 percent.

Assuming electric rates at 2 cents per kilowatt hour and combined motor and pumping efficiencies of 75 percent, the increased cost per year of pump operation amounts to \$79.91, or approximately 8 cents per linear foot of pipe per year. This, capitalized at 4 percent, amounts to \$2.00 per linear foot of pipe. In other words, on the basis of yearly operating cost alone, the use of Transite Pipe would be economical at a cost of \$2.00 more per linear foot than pipe with an estimated design coefficient of 100.

Continued high delivery capacity permits pumps to operate at constant peak efficiency. Freedom from tuberculation eliminates the necessity for running pumps at higher and higher pressures to compensate for decreasing coefficient of flow. Pumps can be chosen for operating more nearly at rates giving peak effi-

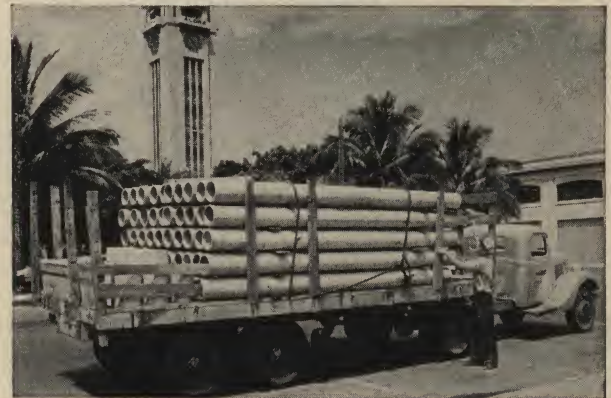
ciency instead of at constantly increased pressures under which conditions pump efficiencies may drop off sharply.



*Annual Power Requirements To Overcome Friction Losses In Pumping 700,000 Gals. Per Day Through 1000 Ft. Of 8" Pipe, With Combined Motor And Pump Efficiency Of 60%.*

Since Transite gives definite assurance against tuberculation, it is not necessary to assume a decreasing coefficient of flow in design work. Therefore, pipe sizes can be chosen in closer accordance with present and future requirements.

Often it is possible to use pipe of smaller diameter than would otherwise be required, without sacrifice of flow capacity. In this way immediate economies are effected. Occasionally, where appropriations are lim-



*More footage may be carried per truck load; fewer men are required for handling*



ited, a more extensive system can be installed through the savings realized by the use of smaller pipe.

Where it is not desired to take advantage of the savings due to the use of smaller diameter pipe, it has been shown that economies are effected in pumping costs or, in the case of gravity systems, hydrant and consumer pressures are greater. In other words, unreduced flow capacity offers substantial advantages regardless of the type of system, usually to the extent of evaluation in dollars and cents.

### Maintenance:

High resistance to corrosion; elimination of tuberculation and electrolysis; tight, flexible joints made possible by the Simplex Coupling; and adaptability to standard water works practice—all these advantages offered by Transite Pipe protect the original cost of investment, and are a safeguard against the dangers and inconvenience of shut-downs, repairs and expensive replacements.

**Soil Corrosion:** Extensive investigations conducted by engineers of the Department of Agriculture, the Bureau of Standards, and private companies indicate that even in a limited area the corrosive intensity of soils may vary greatly. Relatively inactive soils may become highly corrosive with an increase of moisture

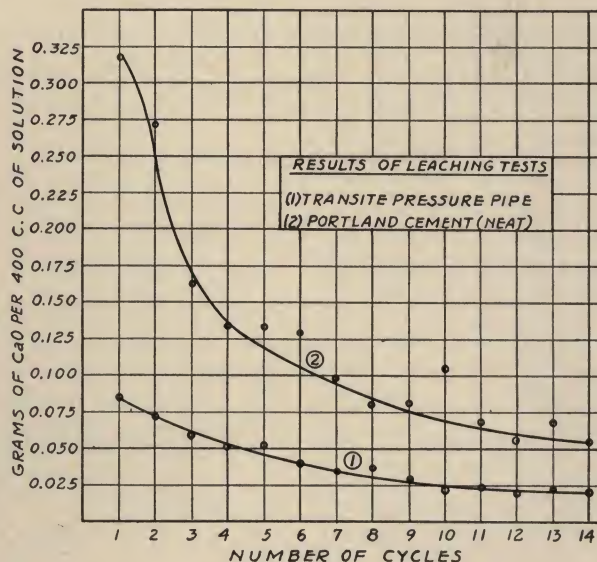


*Transite water mains are highly resistant to corrosion and unaffected by tuberculation and electrolysis*

content or by alteration resulting from changes in drainage, cinder filling, fertilization or other disturbances. It is vitally important, therefore, that pipe lines provide a high degree of corrosion resistance and durability to assure maximum protection against the combined effects of corrosion, internal pressure and soil loadings.



*The flexibility of the Simplex Coupling is assurance against shifting soils, sudden jars and vibrations*



By virtue of its method of manufacture, Transite is highly resistant to chemical corrosion. Due to its composition, consisting largely of insoluble silicates, it is practically unaffected by acids, salts, and alkalis in the concentrations found in soils. An indication of its corrosion resistance is shown by the accompanying chart based on tests conducted by the Underwriters'



Laboratories during their investigation of Transite Pipe. These curves show the relative inertness of Transite as compared with ordinary cement products, and are indicative of its advantages in composition. A fact not brought out by these curves is the extremely dense and tough structure of Transite which acts as a further barrier to corrosive elements.

**Cleaning Eliminated:** Transite Pipe eliminates one other important maintenance charge arising from tuberculation. For reasons of economy, mains are often cleaned from time to time to offset the increased pumping charges and decreased carrying capacity caused by tuberculation. It has been found that cleaning mains is not a permanent remedy but a temporary expedient which has to be repeated at more and more frequent intervals in subsequent years. The cost of cleaning pipe to remove tubercular growths is completely eliminated with Transite Pipe.

**Underground Leakage:** A serious menace to the efficient operation and maintenance of transmission and distribution systems is underground leakage. Many underground leaks are difficult to discover since they never come to the surface. Aside from expensive waste such leaks are the cause of serious street cave-ins

and breaks in mains due to the erosion of the supporting soil caused by the escaping water.

At various times, surveys by independent organizations have revealed startling amounts of leakage in city water systems. Today, efficient operators in the water works industry are conducting their own surveys to eliminate wasteful leakage—a common cause of which originates at the joints.

The flexibility of the Simplex Coupling makes it a particularly effective joint even when subject to sudden jars or ground settling movements, and to shifting soils or vibrations, such as experienced beneath streets, along railroad tracks, or on bridge suspensions.

#### *Underwriters' Approval:*

The Underwriters' Laboratories, of the National Board of Fire Underwriters, have conducted comprehensive tests on Class 150 Transite Pressure Pipe and have approved this class of pipe and couplings for underground service carrying pressures up to 150 lb per square inch. This acceptance was granted after exhaustive tests were conducted in the laboratory, at Johns-Manville factories, and on numerous municipal installations.



*After twenty years, this Transite Pipe installation continues to justify its selection on the basis of economic installation, operation and maintenance*



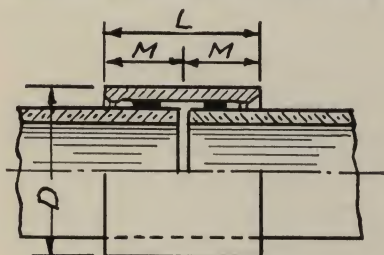
### Other Uses of Transite Pressure Pipe

While Transite Pressure Pipe is most extensively used in municipal transmission and distribution systems, its unusual qualities recommend it for a wide variety of applications where process or waste liquids

are conveyed. Aside from many miles of pipe used in industrial water and fire lines and force sewer mains, Transite Pipe is employed for irrigation lines, acid mine drainage waters, brines, process liquors, stock and white water, and for such applications as salt water and lead lines in the oil industry.

### Classes, Dimensions and Weights

Transite Pressure Pipe is manufactured in three pressure classes as Class 100, 150 and 200, which in-



dicates the maximum working pressure in lb per sq in. for which the pipe is recommended.

Pipe sizes are furnished in 13-foot lengths from 4" to 16" diameter, inclusive. For details, see drawing and accompanying tables.

Transite Pressure Pipe is finished with plain ends, the outside surface of which is machined to receive the Simplex Coupling.

**Dimensions of Simplex Couplings**

Pipe Size, inches	All Classes		Class 100	Class 150	Class 200
	L, in.	M, in.	D, in.	D, in.	D, in.
4	7	3.5	6.45	7.00	7.63
6	7	3.5	8.51	9.10	9.99
8	7	3.5	10.63	11.30	12.31
10	7	3.5	13.41	14.31	15.15
12	8	3.5	15.61	16.87	17.94
14	8	4.0	18.18	19.64	20.74
16	8	4.0	20.58	22.16	23.56

**Standard cast iron fittings that fit Transite Pipe**

Pipe Size, inches	Class 100		Class 150		Class 200	
	Class Fitting	Joint Clearance	Class Fitting	Joint Clearance	Class Fitting	Joint Clearance
4	D	0.50	D	0.42	D	0.25
6	D	0.53	D	0.42	Special Bell	
8	D	0.56	D	0.42	or	
10	D	0.46	Special Bell		Adaptor	
12	D	0.42	or		"	
14	D	0.44	Adaptor		"	
16	D	0.52	"		"	

**Dimensions and Approximate Weights of Transite Pressure Pipe**

Pipe Size, inches	Class 100 For heads of 231 ft of water				Class 150 For heads of 346 ft of water				Class 200 For heads of 462 ft of water				Dimensions based on machined section of pipe. Weight of pipe and coupling computed on basis of 1 coupling per 12 ft of pipe, allowing for normal furnish of random and short lengths
	Thick-ness, inches	Out-side Diameter, inches	Weight, lb per lin ft Pipe Only	Weight, lb per lin ft Incl. Coup.	Thick-ness, inches	Out-side Diameter, inches	Weight, lb per lin ft Pipe Only	Weight, lb per lin ft Incl. Coup.	Thick-ness, inches	Out-side Diameter, inches	Weight, lb per lin ft Pipe Only	Weight, lb per lin ft Incl. Coup.	
4*	0.38	4.70	5.8	6.4	0.45	4.85	6.9	7.6	0.63	5.20	9.2	10.2	
6*	0.46	6.76	10.0	10.8	0.55	6.95	12.0	13.0	0.83	7.50	16.5	17.8	
8*	0.52	8.88	15.0	16.0	0.65	9.15	18.6	19.8	0.96	9.76	25.3	27.0	
10	0.59	11.18	21.2	22.8	0.85	11.70	29.9	31.9	1.10	12.20	38.6	41.0	
12	0.68	13.36	28.6	30.4	0.98	13.96	40.6	43.3	1.24	14.48	51.2	55.0	
14	0.78	15.56	36.4	39.2	1.13	16.26	53.6	57.7	1.44	16.88	68.5	73.5	
16	0.88	17.76	47.8	51.3	1.25	18.50	67.4	72.5	1.65	19.30	89.2	95.6	

\* The pipe sizes given are actual inside diameters with the exception of sizes 4", 6" and 8" which are 3.95", 5.85" and 7.85", respectively.



## Transite Sewer Pipe

The extension of the practice of sewage treatment with the resulting increase in cost of sewage disposal has directed close attention to infiltration, higher flow capacities and other factors. Transite\* Sewer Pipe, which materially aids in the solution of such problems, has largely contributed in the progress toward more efficient and economical gravity-flow systems.

With Transite Sewer Pipe, infiltration is markedly curtailed through a reduction in the number of joints and the use of the scientifically designed Ring-Tite Coupling. Also, a higher flow capacity permits flatter grades with resulting shallower trenches, or the use of smaller diameter pipe. In addition, the pipe affords the advantages of resistance to both internal and external corrosion, uniform strength, flexibility of design, easy installation and less costly maintenance. Economies in planning and installation, as well as in maintenance and operating costs of sewerage systems, are effected by using Transite Sewer Pipe.

### Description

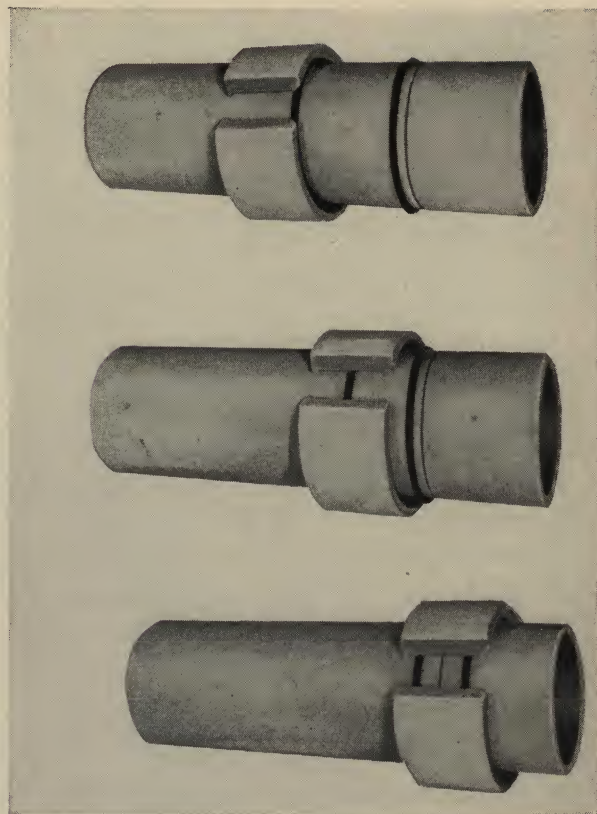
Transite Sewer Pipe is made of an intimate mixture of asbestos, silica and cement. During manufacture the wetted mixture is formed under heavy pressure into a dense, homogeneous material of unusual strength and durability. The asbestos fiber is thoroughly mixed with the cement and serves as a reinforcement. Because of the composition of the finished pipe, it is highly resistant to corrosion and immune to tuberculation and electrolysis. The method of manufacture and the smaller number of joints assure a smooth interior pipe surface which provides a high flow capacity.

Transite Sewer Pipe is used for all kinds of gravity lines, including laterals, sub-mains, mains, intercepting sewers and outfall sewers in sanitary sewer systems.

The pipe is manufactured in 13-ft lengths and in two classes: Class 1 and Class 2. The crushing strength of the pipe in each class is tested in accordance with the A.S.T.M. 3-Edge Bearing Method. Class 1, for service requiring the usual crushing strength, is furnished with inside diameters from 6" to 36"; Class 2, for service demanding extra strong pipe, is furnished with inside diameters from 10" to 36". See table on the reverse of this sheet for complete details.

**Ring-Tite Coupling:** As illustrated, the assembly of the Ring-Tite Coupling involves only the simplest me-

\* Reg. U. S. Pat. Off.



*Ring-Tite Couplings with sleeve cut to show how rubber rings are compressed between sleeve and pipe: Top, start of operation; Middle, sleeve pulled over one ring; Bottom, final position, sleeve centered over joint*

chanical steps: a scientifically designed coupling, of the same composition as the Transite pipe, is drawn over the pipe ends, rolling the pre-located rubber rings into their final position, tightly compressed between the sleeve and the pipe. The joint simplifies installation and remains tight in service to protect against infiltration of ground water and root penetration.

Furthermore, time-consuming procedures such as providing heating equipment, maintaining correct temperatures and the proper bonding of sealing compounds are eliminated with the Ring-Tite Coupling. This is particularly advantageous for wet trench conditions.

By means of a "feeler gage" the correct position of the rubber rings, and therefore the proper assembly of the Ring-Tite Coupling, can be checked immediately after each joint is made . . . before backfilling.

**Force Mains:** Transite Pressure Pipe is used for all force mains. It is available in diameters up to 16" for





*Installing a Transite gravity-sewer main. The Ring-Tite Coupling speeds installation, and allows the pipe to be laid as fast as the trench is opened*

working pressures of 100 and 150 lb per sq in. The tight, flexible joints effected by the use of Simplex Couplings (same principle as the Ring-Tite Coupling) on

Transite Pressure Pipe are widely known in water works practice where this type of coupling has proved highly successful for many years.

#### **Dimensions, Approx. Weights, and Crushing Strengths**

Nominal pipe size, in.	*Dimensions, inches				Weight, lb per lin ft		**Crushing strength lb per lin ft (A.S.T.M. 3-Edge Bearing Method)
	PIPE		RING-TITE COUPLING		Pipe only	Pipe and Ring-Tite Coupling	
	OD	Thickness	OD	Length			
CLASS 1							
6	6.69	0.42	8.71	7.0	8.5	9.1	2600
8	8.81	0.48	10.83	7.0	13.0	13.8	2500
10	11.05	0.50	13.23	7.0	16.7	17.9	2200
12	13.13	0.54	15.35	7.0	21.4	22.8	2200
14	15.21	0.58	17.57	8.0	26.4	28.4	2200
16	17.29	0.62	19.71	8.0	32.2	34.5	2200
18	19.35	0.65	21.81	8.0	37.5	40.1	2100
20	21.43	0.69	23.95	8.0	44.2	47.2	2200
24	25.55	0.75	28.43	9.0	57.0	61.6	2200
30	31.97	0.96	35.27	10.5	90.0	97.2	2800
36	38.35	1.15	42.05	10.5	128.0	138.2	3300
CLASS 2							
10	11.17	0.56	13.51	7.0	18.6	20.0	2800
12	13.33	0.64	15.71	7.0	25.1	26.7	3000
14	15.51	0.73	18.13	8.0	33.2	35.5	3400
16	17.69	0.82	20.45	8.0	42.0	44.8	3700
18	19.85	0.90	22.75	8.0	51.7	55.1	4000
20	21.93	0.94	24.97	8.0	59.8	63.8	4000
24	26.17	1.06	29.71	9.0	80.3	86.5	4200
30	32.53	1.24	36.79	10.5	116.0	126.5	4600
36	38.87	1.41	43.73	10.5	158.0	175.2	5000

\*All dimensions are subject to manufacturing tolerances. Pipe OD and thickness based upon unmachined portion.

\*\*Tested in accordance with the J-M Standard Specification for Transite Asbestos-Cement Sewer Pipe. Standard pipe lengths, 13 ft; not more than 15% of total footage ordered will be shipped in random lengths less than 13 ft but not less than 7 ft; length tolerance  $\pm 1$  in. Short lengths necessary for man-hole and other rigid connections, should be ordered 3 ft 3 in. long for 6 in. size; 6 ft 6 in. long for larger sizes.

#### **Development of Sewerage Systems**

Within the last few decades much progress has been made in the development of efficient sewage disposal. Pollution of water supplies and epidemics resulting from inadequate disposal facilities have been reduced. In many instances legislative action has been taken to reduce stream pollution.

With the introduction of treatment plants, critical attention was focused upon the expensive inefficiencies of the collecting system, chief among which was the infiltration of ground waters into the sewer lines. This seepage not only reduced the useful capacity of the pipe but also added to the expense of sewage treatment. The features introduced with Transite Sewer Pipe make possible the necessary improvements to curtail this expense and achieve an efficient, economical collecting system.

It is generally recognized that the excellence of a system depends upon correct design, efficient and enduring materials, and proper installation. Correct design, including the planning of the system and provision for proper treatment of sewage, is of course the responsibility of the sanitary engineer. The efficiency of the system, the life of the pipe and the facility of its proper installation involve the choice of materials designed to meet these requirements. The advantages introduced with Transite Sewer Pipe facilitate economical design and assure a long-lived material which can be economically installed.



## Advantages of Transite Sewer Pipe

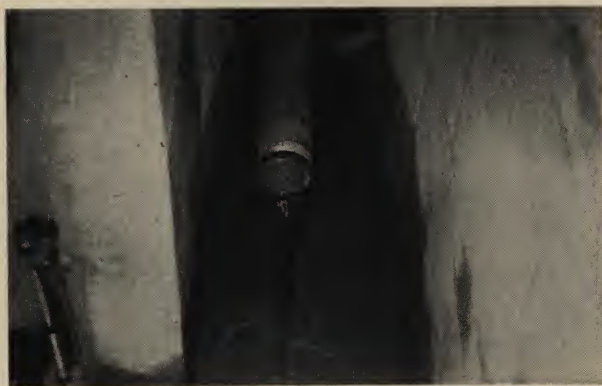
Among the many advantages attained through the use of Transite Sewer Pipe are reduced infiltration, durability, uniform strength, and economies in design, installation and maintenance costs.

### Reduced Infiltration:

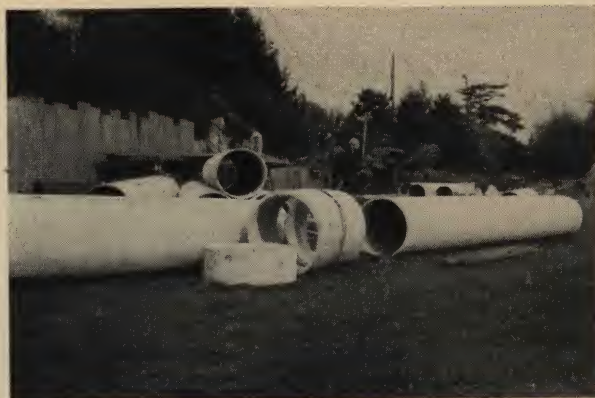
The reduced infiltration made possible through the use of Transite Sewer Pipe achieves important economies in the sewerage system. In planning a sewer system, the engineer recognizes and provides for infiltration by specifying a larger diameter pipe than would otherwise be used. But the cost of treating ground water along with sewage, however, probably presents the great expense.

The cost of infiltration is more fully appreciated when it is considered that from 5,000 to 20,000 gallons of ground water may seep into a mile length of pipe in a day. In extreme cases, over 1,000,000 gallons of infiltration have been encountered per mile of sewer line. In sewage treatment plants designed to provide for the growth of a community over a period of twenty years, it sometimes happens that, because of infiltration, they are found to be operating at capacity after only a few years. Without considering the major cost of providing additional facilities as the community develops, the cost of treating the infiltrate, along with sewage, in itself exacts a considerable toll.

**Causes of Infiltration:** The most important source of infiltration is the ordinary type of pipe joint. Joint leakage may be caused by a number of factors, such as joints opened by shifting of pipe under soil stress or failure of the joint material through shrinkage, loss of bond or disintegration. In other instances, infiltration into the system may occur through the pipe at points



*Total infiltration in an all-Transite sewer system (over 5 miles of pipe) was so little the trickle had to be measured through a 3" pipe inserted in the Parshall flume*



*The long 13-ft pipe lengths and the Ring-Tite Couplings simplify grading, facilitate assembly, and greatly reduce infiltration*

where fracture or corrosion has damaged it. Another important source of infiltration is at fittings installed in the line for future house connections. The ends of these fittings are sealed but, through shrinkage of the sealing material, frequently become a vulnerable point for infiltration. With Transite Sewer Pipe, pre-installation of such fittings is not necessary.

**How Transite Pipe Reduces Infiltration:** With Transite Sewer Pipe the problem of joint leakage is reduced at the outset because of the fewer joints required with the 13-ft lengths. Even more important in preventing infiltration is the Ring-Tite Coupling.

A recently completed "Ring-Tite" installation of 28,540 linear feet of Transite Sewer Pipe, in diameters from 6" through 18", had a total infiltration (including manholes and connections to house sewers) of only a fraction of one gallon (0.85 gal) per inch of diameter, per hour, per mile of pipe. A considerable portion of this installation was below the prevailing ground-water table.

For specification purposes, an infiltration allowance of 10 gallons per inch of diameter, per hour, per mile of pipe may be used with Transite Sewer Pipe. This reduction in infiltration makes possible cutting down on the load at the disposal plant, reducing treatment costs and conserving the disposal plant's capacity for future needs. In the planning of new systems, it permits consideration of smaller treatment plants and smaller diameter sewers, with savings in material, construction and equipment—savings that can be utilized to advantage by extending the system to serve a larger area at no additional cost.

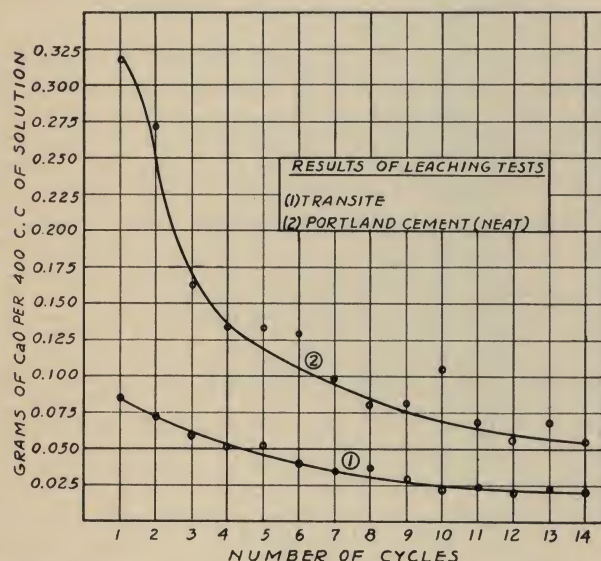
### Durability:

Since the cost of the pipe is often but a small part of the entire project, the durability of the line is of



obvious importance. Because of its resistance to corrosion, Transite Sewer Pipe assures long service life and, moreover, the dense composition of Transite provides maximum resistance to corrosion from both the conditions encountered within the sewerage system and the deteriorating elements that may be present in the surrounding soils. Hundreds of installations in all kinds of soil have proved its resistance to the deteriorating elements encountered.

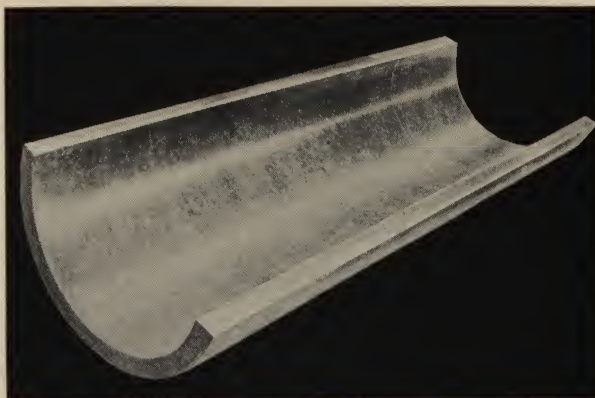
In Transite, the natural chemical stability of the composition is greatly increased. During manufacture, free lime in Transite is converted into insoluble silicates which are not subject to leaching action (leaching-out of any free lime by lime-poor fluids). The chart shows the results of a leaching test which was made upon Transite Pressure Pipe by the Underwriters' Laboratories, Inc. It readily demonstrates the difference of Transite. This advantage, together with the permanence of the asbestos fiber, renders Transite Sewer Pipe resistant to corrosive elements.



*This leaching test readily demonstrates that in Transite, the natural chemical stability of the composition is greatly increased*

### Strength:

The uniform strength of Transite Sewer Pipe is attained through the close control of each step in the manufacturing process which the pipe undergoes—from the grading of the fiber through the building up of the wetted mixture under heavy pressure forming the very dense pipe structure, to machining and inspection. The uniform strength which results from this control of the manufacturing process facilitates the design of a



*The high flow capacity of Transite Sewer Pipe (Manning's  $n=0.010$ ) is a result of its smooth interior surface, long 13-ft lengths and fewer joints*

sewerage system, for, with a uniform crushing strength to start with, the engineer may select the proper combination of pipe strength and bedding method to support the loads under consideration.

In smaller diameter lines the flexural strength of the pipe section is important. The fiber reinforcement of Transite provides this necessary strength. On those sizes where flexural strength is an important consideration, each section of pipe is subjected to a beam test before it is shipped from the factory.

### Design Economies:

With Transite Sewer Pipe flatter grades may be employed to assure proper flow, or smaller diameter pipe may be specified for a given capacity.

The smoothness of the walls (Manning's Coefficient,  $n=0.010$ ) offers less resistance to the flow of sewage and thus sometimes permits the selection of smaller sizes of pipe—or flatter grades for a given size. The economy of a shallower trench, possible through the reduction of the grade, merits particular attention. And the long lengths in which the pipe is furnished assure more accurate maintenance of grade.

The tightness of the joints, by reducing infiltration, permits consideration of a pipe size just large enough to carry the sewage and a minimum amount of ground water. Where the sewage is treated, the saving by the reduction in ground water is recognized, but systems which make no immediate provision for treatment may economize through the use of smaller diameter pipe.

### Installation Economies:

The long lengths in which Transite Sewer Pipe is furnished facilitate its installation. Shallower trenches



are possible. The reduction in the number of joints provides an obvious advantage in the speed of assembly. The pipe is more easily placed to grade and to alignment. And the Ring-Tite Couplings are quickly assembled.

The light weight of the material facilitates the handling of the long lengths. Small crews may be employed for handling pipe, often to the exclusion of mechanical equipment. More linear feet of pipe may be hauled per load with available facilities.

The easy workability of Transite also simplifies its installation. The pipe can be cut with an asbestos-cement pipe cutter or a sharp saw. A hammer and chisel, or drill, can be used to cut connections into the line. There is no need for incorporating connection fittings in the line to anticipate future demands. These can be cut in as required.

In force mains, the use of Simplex Couplings with Transite Pressure Pipe permits rapid assembly and provides a tight, flexible joint.



*With Transite Sewer Pipe flatter grades may be employed to assure proper flow, or a smaller diameter pipe may be specified for a given capacity*



*Long 13-ft lengths and relatively light weight make Transite Sewer Pipe easier, faster and more economical to install*

### **Maintenance Economies:**

Since maintenance charges in a sewerage system often represent an appreciable annual expenditure, a sewer pipe which will minimize the frequency of inspections and the necessity for cleaning, flushing and repair invites the consideration of maintenance men.

Transite Sewer Pipe promotes better velocities of flow and thereby reduces the tendency of solids to settle out with consequent necessity for cleaning. The long lengths stay in more accurate alignment and thereby decrease the possibility of obstructions in the line. The tight joints conform to gradual settlement and prevent the entry of roots which tend to clog the line. And the corrosion-resistance of the material assures long, satisfactory service with a minimum of maintenance.

### **Installation**

The facility with which Transite Sewer Pipe is installed is an important contributing factor toward its economy.

The trench is excavated in the usual manner and, where possible, the excavated material is placed on one side of the trench. When the pipe is unloaded, it can then be strung along the opposite side of the trench, thus minimizing handling. As the work proceeds, the pipe is lowered into the trench by hand, ropes or mechanical means.

The method of bedding the pipe will depend upon surface loads, trench loads, and the supporting strength of the pipe.



***Tight Joints:***

Joint assembly, one of the most important operations in laying the line, is quickly and accurately accomplished. The Ring-Tite Coupling, as previously mentioned, involves only a few, simple steps: As the coupling is pulled over the pipe ends by a coupling puller, the pre-located rubber rings are automatically rolled into position, tightly compressed between the sleeve and the pipe.

***Branch Connections:***

Branch connections to houses, etc., are made by the insertion of cast iron fittings at the desired point. These standard size fittings provide connections at angles of 90 and 45-deg to the Transite main for 4", 5" and 6" connections.

To cut a branch connector into the line, the outline of the inner circumference of the fitting is scribed on the pipe. The portion within the mark is then cut out with power or hand tools and the branch connection reset over the opening to spot the location of the four bolt holes. After drilling the holes, neat portland cement is



*Cuts for branch connections may be quickly made, when and where needed, with power or hand tools*

thoroughly buttered to the wetted surfaces of the Transite Pipe and the fitting. The branch connection is then seated properly, aligned with the bolt holes and pressed into place. Bolts are pushed through from the inside and the nuts tightened evenly.



*Joint assembly, one of the most important operations in laying the line, is quickly and accurately accomplished with the Ring-Tite Coupling*



# Transite Building Sewer Pipe

In recent years, considerable more thought has been given to the selection of pipe used for conveying sewage from houses to the street sewer or to a septic tank. Expensive cleanings to remove roots and even costly replacement of pipe are no longer being considered as unavoidable.

Transite† Building Sewer Pipe is specially designed to meet the practical requirements of house connection service. Its ingenious Ring-Tite† Coupling provides a tight, positive joint that guards against troublesome root growths. The long 10-foot lengths assure simplified installation. This combination of Ring-Tite joints and the longer Transite pipe lengths helps assure a dependable installation.

## Description

The unique grey-white color of Transite is derived from the materials from which the pipe is made— asbestos fibers, portland cement and silica. These are built-up under pressure on a polished steel mandrel and, after the pipe is formed, it is subjected to a special steam-curing process. During this process, the silica combines with the free lime of the portland cement to produce all the durability, strength and corrosion-resistance required of building sewer pipe. In the form of pressure and gravity sewer pipe, Transite has established outstanding records in thousands of cities and towns.

## Dimensions and Weights

Transite Building Sewer Pipe and Fittings are furnished in sizes of 4", 5" and 6", nominal diameters. Standard lengths are 10 feet; half lengths are also available. The pipe is machined both ends to receive the

† Reg. U. S. Pat. Off.



*Transite Pipe and the Ring-Tite Coupling for Building Sewer Service simplifies installation and improves performance*

Ring-Tite Coupling. The Ring-Tite Coupling, furnished with every length of pipe, consists of a sleeve with a built-in T-shaped center ring and two sealing rings which are compressed and rolled into position as joint is assembled. The following table gives approximate weights of pipe, Ring-Tite Couplings and fittings.

## Advantages

The summary of characteristics, shown on the reverse of this sheet, clearly indicates the advantages of Transite Pipe for building sewer service.

## Approximate Weights of Transite Building Sewer Pipe and Fittings

Pipe and Coupling (See Note 1)			Double Bell Fittings (See Note 2)						Machined-End Fittings (See Note 3)						Adaptors (See Note 4)				Increaseers (See Note 5)			
Pipe Size, Diam. inches	Pipe per foot, lb	Cplg. & two rings, lb	Elbows, deg			Branches			Bends, deg				End Cap, lb		Du- Sleeve, lb	Bell plex, lb	& Nip- Spigot, lb		C.I. to Tp Size, Wgt., inches lb		Tp to Tp Size, Wgt., inches lb	
			45,	22½,	11¼,	T,	Y,		45,	22½,	11¼,	Plug,										
			lb	lb	lb	lb	lb		lb	lb	lb	lb	lb		lb	lb	lb	lb				
4	4.7	2.7	5.3	3.9	3.8	8.6	12.1		11.8	7.2	5.0	2.0	1.4		4.4	2.7	3.5	3.0	3x4	2.5	4x5	1.1
5	6.3	3.9	6.3	4.9	4.6	13.2	21.3		19.1	11.5	7.7	2.5	2.5		5.9	3.6	5.7	4.0	2x4	3.4	4x6	2.3
6	7.5	4.5	7.1	6.3	5.2	17.5	27.5		25.7	15.1	9.8	3.0	3.0		6.3	5.5	7.9	4.5	—	—	5x6	1.3

Note 1—Two rubber sealing rings and one coupling included per Pipe length.

Note 2—Two rubber sealing rings included per Fitting.

Note 3—Two rubber sealing rings and one coupling included for Bends; one rubber sealing ring for End Cap.

Note 4—There are two styles of Sleeve, Duplex and Nipple Adaptors. One style connects cast-iron soil pipe or field-cut Transite pipe and is marked C.I. The other connects clay pipe and is marked CLAY.

Note 5—Tp to Tp Increaseer includes one rubber sealing ring for smaller diameter of pipe.

## TRANSHITE BUILDING SEWER PIPE

March, 1953 (Cancelling sheet dated March, 1950)

BMT-690





*The Ring-Tite Coupling combats roots and protects against infiltration of ground water*

**Ring-Tite Coupling:** The Ring-Tite Coupling forms an exceptionally tight joint that guards against root growths, a frequent source of trouble and maintenance in building sewer lines. It also protects against infiltration of ground water into sewer lines, an important factor in reducing the load on sewage treatment plants. In addition, the tight joints help prevent ground pollution with its resultant health hazards. Being a flexible joint, the Ring-Tite Coupling helps prevent excessive flexural stresses from building up in the line, and guards against breaks and opening up of joints resulting from earth settlement.

**Corrosion-Resistant:** Since Transite Building Sewer Pipe is corrosion-resistant "all the way through," it resists sewage inside and soil outside. The durability of the rubber ring gaskets employed with the Ring-Tite Coupling make them particularly suitable for this type of service.

**Strength:** The millions of tough, strong asbestos fibers in its composition reinforces the pipe in much the same manner as steel reinforces concrete structures. This dense, tough structure of Transite prevents shattering, and its resistance to corrosion assures permanence of strength.

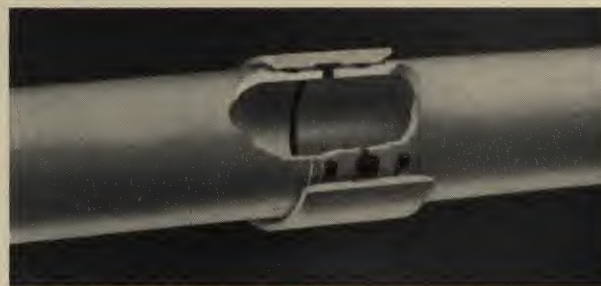
**High Flow Capacity:** The smooth interior surface of Transite Building Sewer Pipe, the long 10-foot lengths, the flush joint formed by the Ring-Tite Coupling's center ring . . . all combine to produce high flow capacity, increased flushing action, and reduces the possibility of sewage accumulation.

**Adaptability:** A variety of Transite Fittings and Adaptors are available for making changes of direction, connections to other pipe, clean-outs, etc. All fittings are made of the same materials as the pipe. Accurate machining assures their quick, easy assembly with the Ring-Tite Coupling.

**Installation:** Light in weight, with fewer joints necessary because of its long, 10-foot lengths, Transite Building Sewer Pipe can be laid to grade quickly and accurately. These long lengths also help keep the line to grade. Transite is so light, a standard 10-foot length of this pipe can easily be carried by one man. These advantages, plus ease of assembly provided by the Ring-Tite Coupling, result in important installation economies.

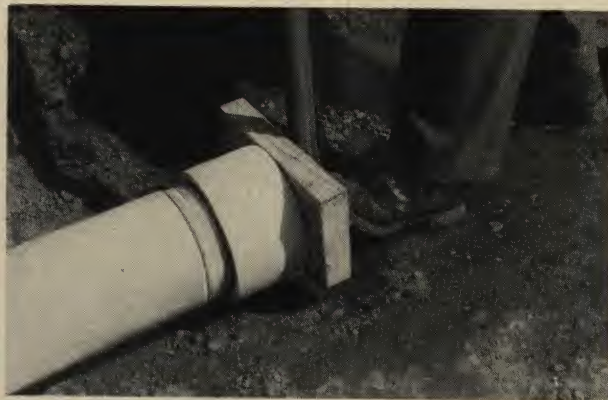
Standard pipe lengths can be easily cut with an ordinary coarse-tooth hacksaw if shorter lengths are needed. Also, a handy tool is available if desired to machine field-cut ends of pipe on the job. The standard ends thus formed add to the wide choice of methods for making connections.

For sealing joints between Transite Building Sewer Pipe Adaptors and cast iron, clay or field-cut Transite Pipe, J-M Calking Rope is recommended. This is a ready-to-use, cold compound which eliminates the use of heating equipment and mixing operations.



*Transite Building Sewer Pipe before and after assembly . . . Above: Showing the machined pipe ends, the two rubber sealing rings, and the Ring-Tite Coupling with the embedded rubber center ring . . . Below: Cut-out showing how rubber sealing rings are compressed between pipe and coupling, and how rubber center ring provides for uninterrupted flow*

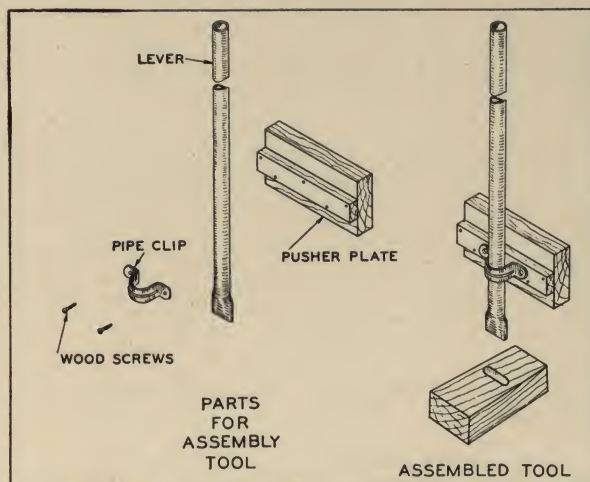


*Method of Assembling Transite Building Sewer Pipe*

*Place a Ring-Tite rubber sealing ring on the end of the pipe within  $\frac{1}{4}$ " of the edge. Before the final positioning, roll the ring back and forth to take out twists and to help square it with the pipe. Place a coupling against the sealing ring on pipe and push into place with the "assembly tool"*



*Place a rubber ring on second pipe length, as above, within  $\frac{1}{4}$ " of the edge and roll. At the other end of this pipe length, use "assembly tool" to push pipe into coupling. Subsequent pipe lengths are assembled by the same procedure*



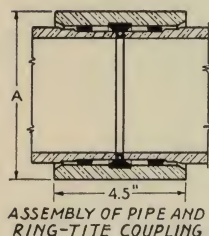
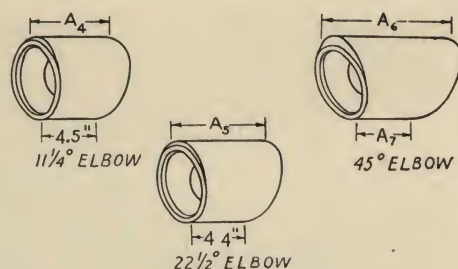
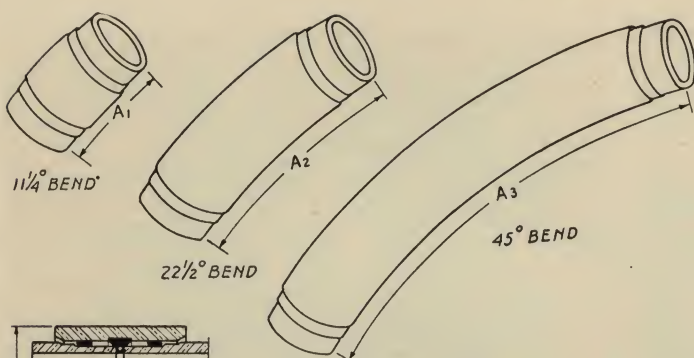
*The only equipment needed to assemble the Ring-Tite Coupling is a lever-type assembly tool easily made from 1" pipe or bar, pipe clip and wooden blocks. To keep tool from slipping in rocky or unstable soil, use wood base at right above*



*The field cut end of Transite Pipe can be machined on the job. The standard ends thus formed offer a wider choice of making various connections*



**Transite Building Sewer Pipe and Fittings**



DIMENSIONS

DIAM.	A	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>	A <sub>11</sub>
4	5.8	7.1	14.1	28.3	5.6	6.8	9.3	4.3	9.1	12.6	5.6	10.6
5	7.1	9.4	18.9	37.7	5.9	7.2	10.2	4.4	10.5	14.3	6.3	11.6
6	8.1	9.4	18.9	37.7	6.1	7.5	10.9	4.2	11.3	15.7	6.8	12.6

ALL DIMENSIONS IN INCHES

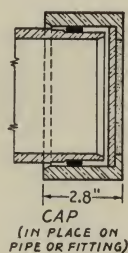
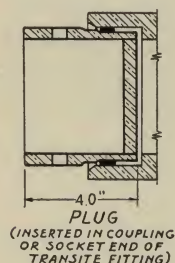
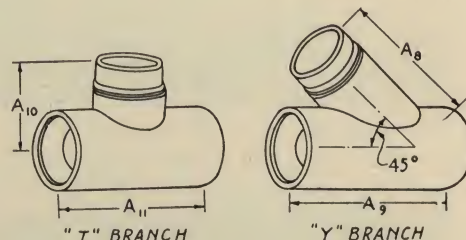
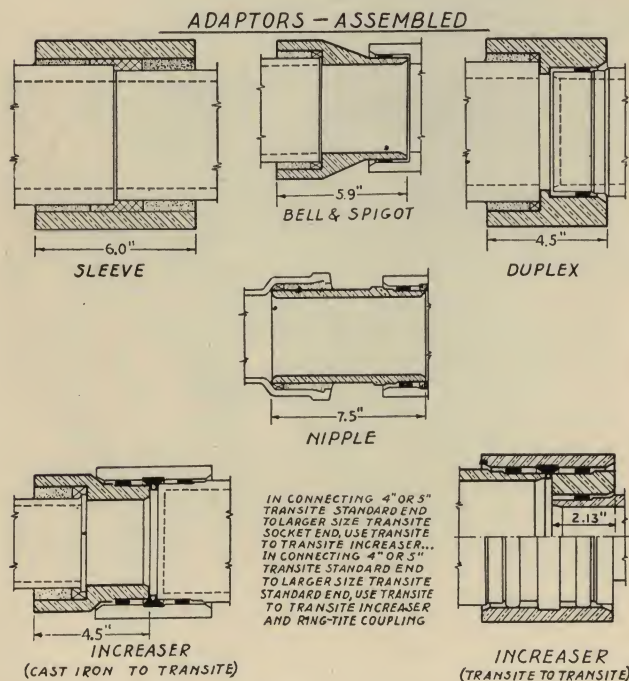


TABLE SHOWING METHODS OF CONNECTING VARIOUS KINDS OF PIPES AND FITTINGS, AND USE OF ADAPTORS IF NEEDED.

TO CONNECT ↓ TO →	TRANSITE STANDARD END	TRANSITE FIELD CUT END	TRANSITE COUPLING OR SOCKET END OF TRANSITE FITTING
TRANSITE STANDARD END	RING-TITE COUPLING	DUPLEX ADAPTOR "C.I."	DIRECTLY
TRANSITE FIELD CUT END	DUPLEX ADAPTOR "C.I."	SLEEVE ADAPTOR "C.I."	BELL & SPIGOT ADAPTOR
TRANSITE COUPLING OR SOCKET END OF TRANSITE FITTING	DIRECTLY	BELL & SPIGOT ADAPTOR	TRANSITE PIPE OR FITTING WITH STANDARD ENDS
CAST IRON SPIGOT END	DUPLEX ADAPTOR "C.I."	SLEEVE ADAPTOR "C.I."	BELL & SPIGOT ADAPTOR
CAST IRON SPIGOT END SMALLER SIZE	INCREASER ADAPTOR "C.I. TO TRANSITE" & RING-TITE COUPLING	INCREASER ADAPTOR "C.I. TO TRANSITE" & DUPLEX ADAPTOR "C.I."	INCREASER ADAPTOR "C.I. TO TRANSITE"
CAST IRON BELL END	NIPPLE ADAPTOR "C.I." AND RING-TITE COUPLING	NIPPLE ADAPTOR "C.I." AND DUPLEX ADAPTOR "C.I."	NIPPLE ADAPTOR "C.I."
CLAY SPIGOT END	DUPLEX ADAPTOR "CLAY"	SLEEVE ADAPTOR "CLAY"	BELL & SPIGOT ADAPTOR "CLAY"*
CLAY BELL END	DIRECTLY	DIRECTLY	TRANSITE PIPE OR FITTING WITH ONE STANDARD END

\* THIS ITEM IS NON-STANDARD  
NOTE:—EXCEPT WHERE RING-TITE RUBBER RING JOINTS ARE EMPLOYED, JOINTS ARE  
YARNED AND CALKED; YARNED WITH ASBESTOS ROPE, HEMP OR OAKUM AND CALKED  
WITH J-M BUILDING SEWER CALKING ROPE (A COLD CALKING COMPOUND  
ESPECIALLY DESIGNED FOR BUILDING SEWER SERVICE), CEMENT OR LEAD.













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# Waterproofing and Miscellaneous Asphalt Products

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## J-M Waterproofing and Damp-proofing

J-M Waterproofing is a treatment designed to render concrete and masonry structures impervious to water, more commonly where hydrostatic pressure exists. Damp-proofing is a protection against the penetration of moisture by absorption and capillary action.

### *Method of Damp-proofing:*

Damp-proofing is ordinarily accomplished by the application of bituminous surface coatings for the purpose of protecting masonry superstructures from damage and to prevent the infiltration of moisture. The protection is effective both above and below ground level as long as no hydrostatic pressure exists.

### *Methods of Waterproofing:*

Experience indicates that positive waterproofing is best accomplished by the membrane method in which a protective envelope is applied to the surface to be waterproofed. The membrane is usually composed of impregnated felts or fabrics bonded together and to the concrete with hot-mopped bitumen. The treatment is usually applied on the outside of the structure so that the water pressure will tend to hold the membrane in place. If applied on the inside, it is usually necessary to overlay the treatment with concrete.

Practice varies as to the use of felts and fabrics. Johns-Manville recommends the use, wherever possible, of asbestos felts and fabrics in combination. The felts are used primarily for water resistance and the fabrics for tensile strength. When fabric is used, it should be placed in the center of the membrane where it is protected from mold and bacterial action. When J-M Asbestos Waterproofing Felts are specified, the theory that the introduction of reinforcing materials other than fabrics supplies a cleavage line in the membrane does not apply, because of thorough asphalt impregnation of the felts. However, standard specifications have been developed calling for the use of saturated fabrics without felts in railroad bridge waterproofing and some other types of work where this practice is well established.

The success of membrane waterproofing depends upon the design of the membrane structure, the selection of the proper bituminous materials and careful workmanship in application. The qualities of permanence, strength and flexibility are essential in the felts and fabrics used in the membranes. The most commonly used bituminous material is asphalt.



*J-M Waterproofing on the Niagara River bridge of the Michigan Central R.R.*

As a matter of expediency, J-M Asphalt Mastic Waterproofing is used in subway construction where abrasion during the progress of the work makes a membrane impractical. This mastic waterproofing is a properly proportioned combination of asphalt and selected mineral filler, thoroughly mixed at a temperature of 450 F and applied to the concrete hot. Sometimes mastic is applied as a cement for brick used to protect the membrane. Often the mastic serves merely as a roof to deflect water to drains. The mastic method is not recommended where the use of a membrane is at all feasible.

### *General Recommendations:*

No definite recommendation can be made to cover any character of construction until the individual requirements of the particular job are analyzed. The condensed specifications on next page serve merely as a guide in waterproofing and damp-proofing work.

If the concrete is dry, the installation should ordinarily be started with an application of J-M Concrete Primer. In cases where the concrete cannot be dried, a J-M No. 50 Asbestos Waterproofing Felt should be used as a base upon which to build the specified membrane. When 5-ply protection is required, the introduction of this sheet results in a 6-ply membrane.





*First layer of J-M Asbestos Waterproofing Felt on the York St. viaduct of the New Union Terminal, Toronto, Canada*

### **Specifications for J-M Waterproofing and Damp-proofing**

The following condensed specifications for various purposes are representative of those in common use:

**Specification No. 1—Waterproofing:** Two plies of J-M No. 50 Asbestos Waterproofing Felt laid in J-M Standard Asphalt Waterproofing Cement. Used in waterproofing concrete railroad bridges, bridge abutments, viaducts, and in other locations where no hydrostatic pressure exists.

**Specification No. 2—Waterproofing:** Two plies of J-M Asphalt-Saturated Waterproofing Fabric laid in J-M Standard Asphalt Waterproofing Cement. Used as an alternate to No. 1 when fabric only is specified.

**Specification No. 3—Waterproofing:** Three plies of J-M 15-lb Asbestos Waterproofing Felt laid in J-M Standard Asphalt Waterproofing Cement. Used for floors, walls and sidewalks, where no pressure exists.

**Specification No. 4—Waterproofing:** Three plies of J-M 15-lb. Asbestos Waterproofing Felt laid in J-M Self-Healing Cement. Used between wood floors.

**Specification No. 5—Waterproofing:** Two plies of J-M No. 50 Asbestos Waterproofing Felt and one central ply of J-M Asphalt-Saturated Waterproofing Fabric, all laid in J-M Standard Asphalt Waterproofing Cement. This specification is as light as should be used in floors and walls where surface seepage may set up hydrostatic pressure. Also used on elevated concrete highways.

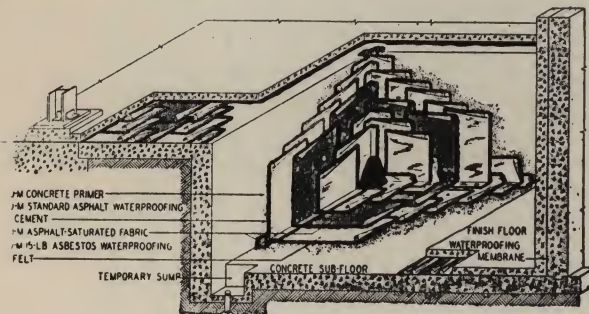
**Specification No. 6—Waterproofing:** Three plies of J-M Asphalt-Saturated Waterproofing Fabric laid in J-M Standard Asphalt Waterproofing Cement. Used as an alternate to No. 5 where fabric only is specified. Sometimes used in preference to No. 2 where greater strength is required.

**Specification No. 7—Waterproofing:** Four plies of J-M 15-lb Asbestos Waterproofing Felt with one central ply of J-M Asphalt-Saturated Waterproofing Fabric, all laid in J-M Standard Asphalt Waterproofing Cement. Used on floors and walls of foundation work, where hydrostatic pressure will not exceed 10 ft of water. As the grade line is approached, it may be shingled off to 3-ply. Deep foundation work requires special attention.

**Specification No. 8—Damp-proofing:** Two coats of Aquadam applied 24 hours apart. No primer is necessary where Aquadam is to be applied. This specification is used on the inside surface of exterior walls above grade, before applying the usual plaster base.

**Specification No. 9—Damp-proofing:** One mopping of J-M Standard Asphalt Waterproofing Cement. Used on the exterior of foundation walls below grade where conditions are mild.

**Specification No. 10—Damp-proofing:** One ply of J-M 15-lb Asbestos Waterproofing Felt laid in J-M Standard Asphalt Waterproofing Cement. Used on the exterior of foundation walls below grade.



*Waterproofing specification No. 7 applied to basement foundation and elevator or boiler pit. Pumps on the sump relieve ground water hydrostatic pressure until the sub-floor is set, waterproofing applied, and the finish floor completed, after which the sump is closed and similarly waterproofed. Concrete reinforcing is not shown*

Johns-Manville waterproofing and damp-proofing materials are supplied to contractors with full directions for application. As to the materials themselves, Johns-Manville assumes full responsibility for quality.



## J-M Waterproofing and Damp-proofing Materials

### J-M Waterproofing Fabric

J-M Type A Asphalt-Saturated Waterproofing Fabric is a woven cotton material weighing approximately 4 oz per sq yd before saturation and about 13 oz per sq yd after saturation.

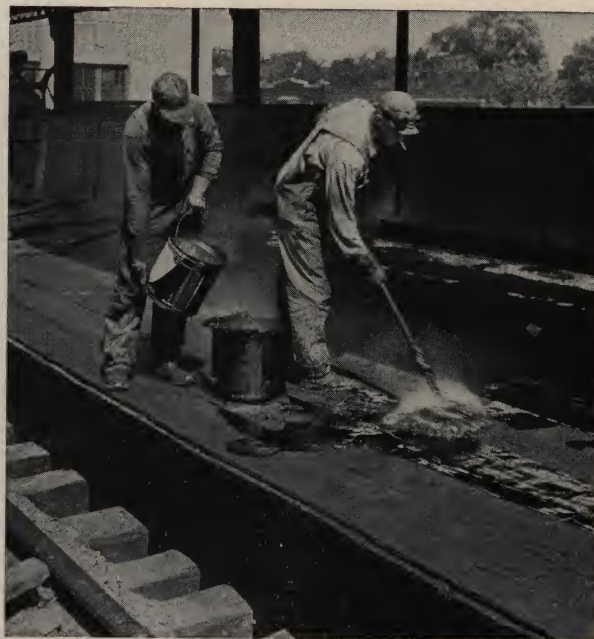
Its strength by the grab method is 50 x 50. Standard rolls, about 37" wide, contain approximately 522 sq ft. Each ply will run 1.1 squares per 100 sq ft of surface to be covered.

J-M Double Coated Waterproofing Fabric Type C, designed for spandrel waterproofing work, is an asphalt-saturated cotton fabric which is coated with asphalt on both sides. The coating permits embedment in a suitable plastic, such as J-M Bituminous Putty, without an outside finish coat. Weight per sq yd before asphaltting, 4 oz; finished weight, 2.5 lb. Furnished in rolls about 37" wide containing approximately 270 sq ft. Weight, 76 lb per roll.

### J-M Waterproofing Felts

J-M No. 50 Asbestos Waterproofing Felt is a strong, asphalt-impregnated felt furnished plain or perforated in two-square rolls (216 sq ft), 32" wide, weighing about 64 lb per roll.

J-M 15-lb. Asbestos Waterproofing Felt is similar to No. 50 but lighter in weight. It is most often used



*Applying J-M Waterproofing on a large railroad passenger depot*

in connection with fabrics or No. 50 felt in membrane waterproofing. Furnished in three-square rolls (324 sq ft), 32" wide. Weight about 45 lb per roll.

J-M No. 1 Acid Resisting Felt is an asphalt-saturated and coated rag felt used with J-M Industrial Flooring over concrete or wood sub-base where liquids, particularly acids, are present in volume. Felts are laid dry; the heat of the flooring, when applied, bonding them together. Furnished in one-square rolls (108 sq ft), 36" wide.

Each ply will run square for square with the work.

### Cements, Primers and Coatings

J-M Standard Asphalt Waterproofing Cement is an exceptionally pure, solid asphaltic compound, generally useful in waterproofing work under normal conditions. This J-M Cement is remarkably immune to the action of acids, alkali, brine and water. Its penetration ranges from 50 to 55.

The cement is heated to a temperature not exceeding 400 deg. F. and mopped on while hot. One ton will cover approximately 3,000 sq ft of surface,  $\frac{1}{8}$ " thick. Shipped in drums averaging about 500 lb.

Waterproofing asphalts for special temperature conditions are also available where circumstances require.



*J-M Waterproofing over a sidewalk vault*

PRODUCT INFORMATION IS SUBJECT TO FREQUENT CHANGE. THE EXACT DETAILS AND AVAILABILITY AT PARTICULAR LOCATIONS SHOULD BE CHECKED WITH THE NEAREST JOHNS-MANVILLE OFFICE.



**J-M Concrete Primer** is a thin, scientifically compounded, asphalt primer for non-combustible surfaces to counteract the dust film, to prevent moisture absorption and to afford anchorage for subsequent bituminous applications. Gypsum or other porous surfaces require two coats to assure positive results.

J-M Concrete Primer weighs approximately  $8\frac{1}{2}$  lb per gal. Its covering capacity, varying with the surface porosity, averages about 100 sq ft per gallon. It is furnished in 1, 5, or 30, and 50-gal containers.

**J-M Bitumen Enamel** is an acid and alkali-resisting solid asphaltic material, with a high resistance to temperature and to shock, for the protection of metal and concrete surfaces which are subject to corrosion from air or aqueous solutions. It is made to comply with U. S. Navy Specification 52-P-17. The covering capacity is approximately 200 sq ft per 100 lb, applied  $1/16''$  thick. Furnished in 500-lb drums.

Bitumen Enamel is heated to 450 F and applied with Bituminous Daubers, Type No. 175. When the fumes become too strong in enclosed places, it may be necessary to alternate the work.

**J-M Asbestos Fibrous Roof Coating** is a black, asphaltic-asbestos compound used to form a weather-resisting protective coating that is both durable and elastic under varied weather conditions.

The coating is applied in two coats to clean dry surfaces. In cold weather, it should be placed in a room and warmed to 70 F prior to use.

Asbestos Fibrous Roof Coating is furnished in two consistencies, with a covering capacity of 75 to 150 sq ft per gal, depending on condition of surface and whether coating is ground or unground. The ground type is for use on roofs in good condition. The unground is best suited for roofs which are showing signs of wear, such as coating cracks and bare spots. This material is shipped in 5-gal cans and 25-30 and 50-55-gal drums; also in 1-gal cans (6 per carton).

**J-M Pickling Tank Cement** is an asphaltic compound used in lining wood and concrete tanks where



*Mopping-in J-M Asbestos Waterproofing Felt*

an acid-resisting coat is necessary. On wood tanks the tongues and grooves are coated before joining and after the tank has been erected, it is primed and given from two to four coats of Pickling Tank Cement.

To apply, the cement is heated to not more than 450 F, and mopped on the surface while hot. When heating, it should be stirred constantly. Furnished, regularly, with a melting point of 150 F in 635-lb drums. A harder material can also be supplied with a melting point of 212 F.

**J-M Bituminous Putty** is an asphalt-asbestos compound that forms an elastic bond which is but little affected by temperature change and vibration. It is used as a filler and flashing to prevent water infiltration in recesses where a permanent seal is difficult to maintain. Furnished in 10-lb cans (12 per case), 50-lb cans and 500-lb drums.



## J-M Asbestos Pipe Line Felts

The generally accepted theory of underground corrosion attributes this effect to various causes, chief of which is the electro-chemical action of moisture, soil chemicals and pipe constituents which result in the formation of a series of minute electric batteries on the surface of the pipe itself. Added to this is the further damage from electrolysis occasioned by stray electrical currents. Leakage from trolley system or other power sources seeks the pipe as the path of least resistance. Where this current leaves the pipe, electrolytic pitting or "graphitic corrosion" occurs.

Long trunk lines apparently pick up earth currents from their connecting structures, independent of outside electrical power, and these "long-line currents" are similar corrosive agents.

With the extension of fertilization, cultivation, electric power, improvement in property, soil conditions tend to become more and more unfavorable. While it is true that all soils are not equally corrosive because of their different percentages of alkalinity, acidity, soluble salts, and their electrical resistance, any soil which is mildly corrosive may become highly corrosive with an increase in moisture content or change in chemical characteristics, due to fertilization of the soil, alterations in drainage, or to cinder filling.

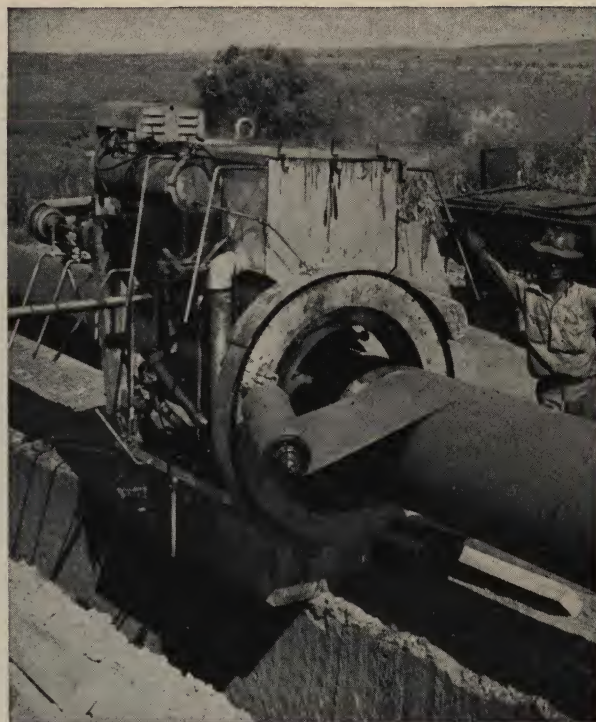
### Economics of Protection

Pipe laid underground merits protection to a far greater extent than steel structures above ground, where protection is always applied. The underground structure of a pipe line is not readily inspected and reconditioning a pipe line costs from three to five times as much as adequate protection when the line is laid.

The use of thin-walled pipe means a greater susceptibility to penetration from corrosion, unless the pipe is adequately protected, and replacement of pipe now being laid will cost considerably more than the present figures.

Proper protection of underground pipe is the lowest insurance against costly reconditioning, loss of operating revenue during shut-downs and the hazard of damage liabilities.

Manifestly, the cost of pipe protection must not be in excess of the value of the additional pipe life. The complete installed cost per linear foot of adequate protection by field application ranges upward from



*In the modern application of pipe protection, J-M Asbestos Pipe Line Felts are applied with the Power-Driven Coating and Wrapping Machine simultaneously with the coating*

1½¢ per inch nominal diameter, depending upon the length of the line and other conditions. The usual cost for adequate protection is from 6 to 8 percent of the cost of the line.

### Pipe Line Protection Shields

Underground pipe line protection should include a wrapper, as a reinforcement or shield. The full effect of the waterproofing qualities of a coating material cannot be obtained unless some means is employed to reinforce it against distortion and abrasion.

The most generally used coatings are of bitumen base. Whether composed of plain asphalt or plain coal tar or filled asphalt or filled coal tar (pipe line enamels), it is true that they are all plastic solids and are subject to distortion by the continual pressure of the soil contacts.

The nature of the backfill, the weight of the pipe, and the characteristics of the bitumen all affect the speed of distortion. Attempts to make a pipe coating material rigid enough to resist plastic distortion are accompanied by the possibility of producing a sub-



stance so brittle that it cracks under the usual pipe line stresses.

In addition to this distortion of a non-reinforced or unshielded coating from the dead weight of the back-fill, there is, with many soils, an adhesion to and pulling away of the coating, due to the shrinkage that comes from the wetting and drying of soils containing clay. This action is evidenced on the surface by wide cracks when the soil is dry, and in some soils this "soil stress" is so pronounced as to rupture the bitumen or pull it from the pipe.

Since the soil, with every change of season and with alteration of moisture content and temperature, exerts a pressing, shifting, or squeezing action on the pipe protection, the shield or reinforcement must be of a material that will last underground for the service life of the pipe. Such materials are J-M Asbestos Pipe Line Felt and Asbestos Pipe Line Fabric.

Asbestos fiber is non-tubular and hence will not support capillary action or draw in moisture, or admit of the lighter fractions of the bitumen being drawn out to the soil. Any rag or other organic fiber is tubular.

The use of asbestos felt is a distinct economy. Its additional cost over rag felt is but a small fraction of the cost of the complete protection (usually less than 10 percent) and exterior coatings, essential to any organic material are unnecessary with asbestos felt, the only type of wrapper which has a record of over 40 years in underground service.

**J-M Asbestos Pipe Line Felt:** A dry asbestos felt, having not less than 85% asbestos content, which is thoroughly saturated with selected coke-oven tar or water-resisting asphaltic compound. The strength of the felt is ample for wrapping pipe as large as 90" in diameter; yet it is flexible enough to wrap 1/2" diameter pipe.

The felt is furnished in rolls of any width up to 45" for asphalt-saturated and 60" for tar-saturated felt. It is usually furnished between 13 1/2 lb and 15 lb per 100 sq ft, but other weights and thicknesses may be secured on order.

The tar-saturated Asbestos Pipe Line Felt meets all requirements of the American Water Works Association Specifications 7A.5—1940 and 7A.6—1940, as well as Navy Department, Bureau of Yards and Docks Specification 34Ya (INT), October, 1939.

**J-M Asbestos Pipe Line Fabric:** Open-mesh asbestos cloth which has been thoroughly saturated with a selected coke-oven tar or a water-resisting asphaltic compound. It is used for wrapping couplings, fit-

tings, irregular surfaces and, where soil stress is severe, even the pipe. On large pipe, which are subject to distortion prior to laying, the fabric reinforces the protective coating against the injurious effects of the distortion or "squatting."

The fabric is furnished in rolls with a 2" i.d. containing 75 or 150 lin ft, but other lengths are supplied on special order. Widths from 2" to 36" are available in increments of 1/2". The finished material weighs approximately 22 lb per 100 sq ft.

Orders for J-M Pipe Line Felts should specify:

1. Quantity of felt in squares.
2. Type of felt: Tar-saturated or asphalt-saturated. (Talc surface should be specified for an unbonded job.)
3. Width of felt desired, or nominal diameter of pipe to be wrapped as shown in the following table.
4. Type of application: Machine, mill, yard or hand wrapping as indicated in table following.

Standards for Various Methods of Wrappings

<i>Machine Wrapping</i>	Width of Roll, inches			Length of Roll, (approx.) ft.	Outside dia.* of Roll (approx.) inches
	Pipe size, inches	Felt only	Felt & Kraft		
Power-driven Coating & Wrapping Machine	4 6 8 to 12 14 to 26	6 6 9 12	6 9 12 18	400	12
Rotary Type Machine	4 6 to 8 10 to 16 18	Felt only 6 9 12 18		150	7½
Saddle Type Machine	12 to 16 18 to 24	12 18		150	7½
Ditch Type Machine	4 6 to 8 10 to 12	6 9 12	For work in ditch 85   6 For work above ditch 150   7½		
<i>Mill Wrapping</i>	All	2 2½ 3	2,400	24	
Hill-Hubbell Company		4 6 8 9 12 16	2,800	30	
		Yard Wrapping	2 2½ 3 4 5 6 7 10½	950	18
	¾ to 6 incl.				
	Carroll Type Machine				
<i>Hand Wrapping</i>	4 6 to 8 10 to 16 18 to 36	6 9 12 18	50	4	
Lateral Sheet and straight-away methods	2 to 30	36	187½	8½	

\*All rolls have an inside (or core) diameter of 2 inches unless specified otherwise.



# Mechanical Coating and Wrapping Equipment

The modern method of applying pipe protection in the field is to use machines which place the coating and the felt on the pipe simultaneously. Machines are available which are highly efficient and which provide a consistently superior protective envelope.

Typical of such mechanical coating and wrapping equipment is the J-M Power-Driven Coating and Wrapping Machine, a self-propelled unit which in one operation applies a uniform coating and a single or double layer of wrapper. The flexibility, precision, speed and economy attained with this machine are reflected in the satisfaction expressed by its users.

Other equipment designed for the efficient application of protective felts are three J-M field wrapping machines: the Rotary Type, Saddle Type and Ditch Type as described in following paragraphs.

**Power-Driven Coating and Wrapping Machine:** This machine is available for pipe from 4" to 26" diameter, inclusive. The coating part of the machine consists of a hopper at the bottom of which is an adjustable valve through which the coating is flowed on the pipe. That portion of the machine surrounding the lower part of the pipe is equipped with an adjustable shoe which controls the thickness of the coating and smooths it on. Below is a drip pan to catch any overflow of coating, which is then returned to the hopper by a recirculating pump. Tar or asphalt enamels or grease type coatings may be used.

The wrapping is accomplished by two felt-heads which revolve around the pipe when the machine is in operation. The heads may be adjusted to wrap a single bonded layer of asbestos felt; one bonded and



*J-M Power-Driven Coating and Wrapping Machine applying coating and wrapping in a single operation*

one unbonded felt; one unbonded felt, separated from the coating by a layer of kraft paper; or a bonded asbestos felt with an unbonded layer of kraft.

The machine is powered by a small gasoline engine which propels the unit along the pipe and operates the recirculating pump and felt-heads. An attached pole permits one man to keep the machine balanced.

The machine coats and wraps over welds, collar patches and bell-end pipe as well as around side bends and up-hill at an angle as great as 45 degrees. The engine is capable of a speed of 4800 ft per hour. Under normal operating conditions over rough ground an average speed of 2400 ft per hour is conservative.

The unit is shipped assembled, ready to be slipped over one end of the line. For made-up lines a few parts are removed from the bottom of the machine and the upper portion lifted on the pipe with a boom. The machine requires an operating clearance of about 15" between the pipe and the ground. Approximate machine weights are as follows:

Sizes, inches	Wt., lb.	Sizes, inches	Wt., lb.
4	750	14 and 16	2100
6 and 8	1200	18, 20, 22 and 24	3850
10 and 12	1750	26	3950

**Rotary Type Wrapping Machine:** Briefly, this machine consists of circular angle-frames carrying a roll of felt, the entire load being supported on spring-mounted rubber rollers with ball bearings. These rollers serve the purposes of supporting the frame, determining the travel of the machine, and ironing out all wrinkles in the felt as it is wrapped on the pipe.



*J-M Rotary Type Wrapping Machine applying pipe line felt. Crew at the left are coating the pipe*





*J-M Saddle Type Wrapping Machine applying felt to a rotating 24" pipe*

They are so located that they can ride only on the wrapped part of the pipe. A clearance between pipe and ground of 11" to 15" is required for operation.

The frame is split and hinged for disassembling so that the machine can be readily and quickly put on or taken off the line. It weighs approximately 400 lb. complete and is easily operated by a two-man crew. To change the lap requires only a simple adjustment. The machine progresses at the rate of 15 feet per minute and wraps from one to two miles per day.

The Rotary Type Wrapping Machine is spun and moves along the stationary pipe. It is designed for welded or screwed lines, where considerable stretches of pipe are available, and for lines which are Dresser or Dayton coupled at intervals exceeding 80 feet. For the latter use, the machine is fitted with a quick release latch so it can be readily moved over the coupling.

Machines are available for lines from 4" to 18" dia., inclusive. They will wrap from two to three sizes of pipe, according to the size of the machine.

**Saddle Type Wrapping Machine:** This machine is virtually the upper half of the Rotary Type machine and is designed for field-wrapping lines that are frequently interrupted with Dresser or Dayton type couplings at intervals of 80 feet or less. With this machine, wrapping is done alongside the ditch.

The pipe is rotated by a "rolling rig" turned by a portable gasoline or air motor, and the Saddle Type machine rides along from one end of the length of pipe to the other. On pipe heavy enough to rotate without undue sway, the Saddle Type can be used for lengths up to 120 feet. The machine is capable of wrapping over 15,000 ft. of 20" pipe per day.

Only sufficient ground clearance is necessary to avoid picking up dirt, grass, or other foreign matter, by the coating as applied to the rotating pipe. The rolling rig skids automatically give 6" clearance, which is usually ample. The machine is available in sizes to fit lines from 12" to 24" dia., inclusive.

**Ditch Type Wrapping Machine:** In reconditioning work there are times when it is not desirable to raise the pipe line a sufficient distance to give proper clearance for the standard Rotary Type Wrapping Machine. Or, at other times, the right-of-way may be very narrow. The Ditch Type Wrapping Machine is designed for such service. It is a modification of the Rotary Type in which the clearance is reduced to 8". The Ditch Type machine weighs slightly less than the Rotary and is more compact. It is available in sizes to fit 4" to 12" dia. pipe, inclusive.

#### Dimensions of Felt Rolls for Various Machines

Type of Machine	Approximate Length, feet	Outside Diameter of Roll, inches
Power-driven machine	400	12
Rotary and Saddle types	150	7½
Ditch type:		
For ditch work	85	6
for work above ditch	150	7½

All rolls of felt are furnished with a 2" inside diameter.

In ordering either felt or machine, the following information must be given:

- (a) Nominal pipe diameter; (b) Width of the felt;
- (c) External diameter of felt roll. (See table above.)

The Johns-Manville machines are leased on a daily rental or a "per linear foot of pipe wrapped" basis, dependent on the size and duration of the job. Machines are carried at various stock points.



*Looking down on a J-M Ditch Type machine from the leading end, showing the felt roll head and compact design*











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Description . . . . .	EL-300
<i>Sealing Compounds (Uniseal, Duxseal, Navaseal, Pakseal, Tranolseal and Nodrseal):</i>	
Description and application . . . . .	EL-160
<i>Trancell Materials:</i>	
Description . . . . .	EL-55 to 59
<i>Transite Asbestos Sheets (for electrical purposes):</i>	
Description and applications . . . . .	EL-50
<i>Transite Conduit and Transite Korduct:</i>	
Description and accessories . . . . .	EL-200 to 203

(For complete list of data sheets, see other side of this page)



## Electrical Materials

### Complete List of Data Sheets Available

#### *Asbestos-Cement Sheets:*

Shop working . . . . . EL-86 and 87

#### *Asbestos Ebony:*

★Descriptions . . . . . EL-1 and 100

#### *Asbestos Paper Tapes, Tubing and Listings:*

★Descriptions . . . . . EL-350

#### *Chemstone:*

★Description and uses . . . . . EL-80

Construction details . . . . . EL-85

Pulp and paper industry . . . . . EL-90 to 96

#### *Electrobestos:*

★Description . . . . . EL-100

#### *Friction Tapes:*

Competitive brands and J-M equivalents . . . . . EL-305

★Description . . . . . EL-300

#### *Jomanco Plastic Electrical Tape:*

★Description . . . . . EL-290

#### *Niagrite-Asbestoment Cable Fireproofing:*

★Description and application . . . . . EL-150

#### *Ohmstone:*

★Description . . . . . EL-10

#### *Quinorgo Electrical Insulations:*

★Description . . . . . EL-400 to 404, 420

#### *Quinterra Electrical Insulations:*

★Description and uses . . . . . EL-360 to 370, 425

#### *Rubber Tapes:*

Competitive brands and J-M equivalents . . . . . EL-305

★Description . . . . . EL-300

#### *Sealing Compounds (Uniseal, Duxseal, Navaseal, Pakseal, Tranolseal and Nodrseal):*

★Description and application . . . . . EL-160

Miscellaneous applications . . . . . EL-165

#### *Trancell Materials:*

★Description . . . . . EL-55 to 59

Housing Electrical Equipment . . . . . EL-65 to 72

#### *Transite Asbestos Sheets (for electrical purposes):*

★Description, application and cable trays . . . . . EL-50

#### *Transite Conduit and Transite Korduct:*

★Description and accessories . . . . . EL-200 to 203

Installation, fittings and typical illustrations . . . . . EL-204 to 217

Specifications . . . . . EL-244 to 247

Underground subway cable systems, Transite Conduit in . . . . . EL-228 to 240

★Catalog pages



## Asbestos Ebony



*Asbestos Ebony is an ideal electrical panelling, ebony-like in appearance, which is employed for switchboards, controller plates, switch bases, bus-bar supports, etc.*

Asbestos Ebony\* meets the many requirements for an electrical panel-board material. It combines high dielectric strength and insulation resistance with mechanical strength and relative permanence. It is unaffected by water, oil, gas and ordinary chemicals. Asbestos Ebony, purely a mineral product, is composed of asbestos fiber and portland cement bonded under tremendous pressure and impregnated with a special asphaltic insulating compound. Because of its structure, it will withstand impact shock and vibration and is unaffected by rapid temperature changes.

Asbestos Ebony has a history of many years of dependable service as a panel board for switchboards, controller plates, switch bases, bus bar supports, and as insulating spacers in a wide range of electrical apparatus. Furnished in thicknesses from  $\frac{1}{8}$ " to 4", its uses range from a base panel for low-voltage knife switches to heavy shock resistant base panels for high-speed air circuit breakers.

The very low moisture absorption characteristic of the material permits its use in damp locations. Being of monolithic structure, it will not delaminate, shrink, or crack under severe service conditions. Under moist conditions, it will not rust or corrode—maintenance requirements are held to a minimum.

The high dielectric strength of Asbestos Ebony provides a comfortable margin of safety for the design of electrical apparatus. The dielectric strength of  $\frac{1}{4}$ "

thick material is 6250 volts and for  $1\frac{1}{2}$ " thickness 45,000 volts.

Asbestos Ebony is furnished in large size sheets or in panel form fabricated to blueprint specifications.

Nominal Blank Size, Inches	Thickness, Inches
36" x 48"	$\frac{1}{8}$ " and $\frac{3}{16}$ "
42" x 48"	$\frac{1}{4}$ " thru 4"
42" x 96"	$\frac{1}{4}$ " thru 4"
48" x 48"	$\frac{1}{4}$ " thru 2"
48" x 96"	$\frac{1}{4}$ " thru 2"

Standard blanks are shipped with edges untrimmed unless otherwise specified. When ordered, one side and end will be trimmed smooth so as to give an accurate 90-deg included angle. Users who do their own fabricating usually order the blanks trimmed in this manner. When requested, blanks will be trimmed on all edges to the nominal-sheet size.

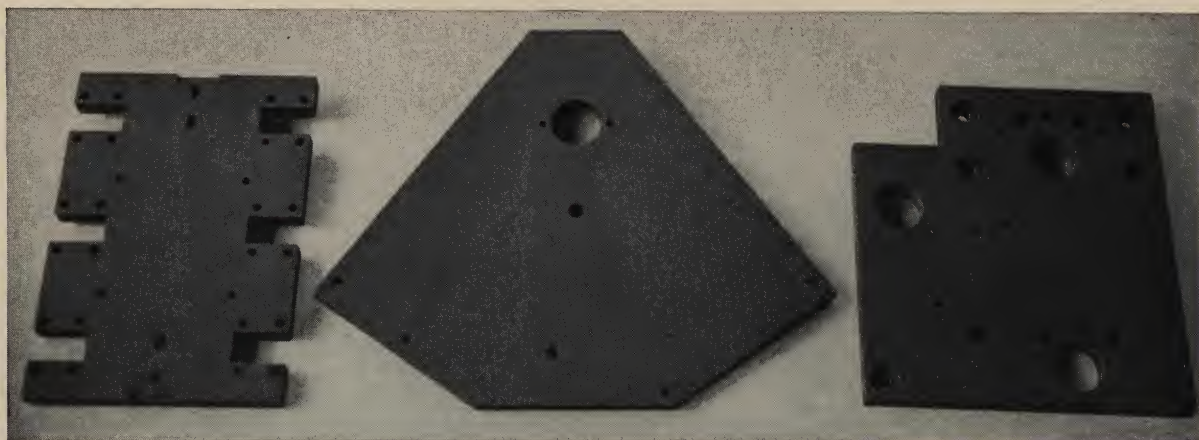
### *Physical and Electrical Properties, 1"-Thick Material*

Density, lb per cu ft, min . . . . .	120
Water Absorption, % dry wt, 48-hr immersion . . . . .	1.0
Modulus of Rupture, psi, min . . . . .	4000
Brinell Hardness, min—max . . . . .	17-40
Temperature limit, F . . . . .	250
Dielectric strength, volts . . . . .	38,000
Surface Resistance*, megohms, min . . . . .	30,000
Volume Resistance*, megohm in., min . . . . .	23,000
Arc Resistance, total sec-ave . . . . .	195

\* Reg. U. S. Pat. Off.

\* ASTM Spec D 257-46, after conditioning 24 hours at 50 RH, 100 F.





*Panels to meet individual specifications are readily fabricated*

### Finish

J-M Asbestos Ebony is regularly furnished with a fine, smooth surface, lacquered on one side in deep, everlasting black "switchboard" finish.

When required, as in the case of barriers, this same finish may also be obtained, at slight extra cost, on the reverse side of sheets which are  $\frac{1}{4}$ " thick or greater.

Although Asbestos Ebony is regularly finished in lacquer, all thicknesses can be furnished unlacquered. There is, however, no allowance made for the omission of lacquer on sheets or panels.

### Sizes and Weights

Thickness,* in inches	Sheet Sizes,† in inches	Approximate Weight, lb per sq ft	
		Uncrated	Crated
$\frac{1}{8}$	36 x 48 only	1.3	1.5
$\frac{3}{16}$		2.0	2.3
$\frac{1}{4}$		2.6	3.0
$\frac{5}{16}$		3.4	3.8
$\frac{3}{8}$		4.0	4.5
$\frac{1}{2}$	42 x 48, 48 x 48 42 x 96 and 48 x 96	5.3	6.0
$\frac{5}{8}$		6.8	7.5
$\frac{3}{4}$		7.9	9.0
$\frac{7}{8}$		9.2	10.5
1		10.6	12.0
$1\frac{1}{4}$	42 x 48 and 42 x 96	13.2	15.0
$1\frac{1}{2}$		15.8	18.0
$1\frac{3}{4}$		18.4	21.0
2		21.1	24.0
$2\frac{1}{2}$		26.0	30.0
3		31.2	36.0
$3\frac{1}{2}$		36.4	42.0
4		41.5	48.0

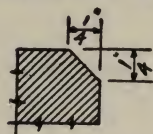
\* All Asbestos Ebony is furnished  $\pm \frac{3}{64}$ " on thickness  $\frac{1}{8}$ " to 1" inclusive, and  $\pm \frac{1}{16}$ " on thicknesses over 1".

† Standard uncut sheets measure a fraction of an inch larger than nominal sizes given. When ordered to nominal sheet size, tolerance will be  $\pm \frac{1}{32}$ ".

Cut panels can be furnished within the size limitations of standard sheets. The tolerance is  $\pm \frac{1}{32}$ " on length and width. Holes can be drilled to an accuracy of  $\pm \frac{1}{32}$ ".

### Bevels

Any desired bevel may be furnished but bevels are usually  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ", or  $\frac{1}{2}$ ", with  $\frac{1}{4}$ " the most popular. Bevels are measured as per sketch; thus a  $\frac{1}{4}$ " bevel would have a projected measurement across face of panel of  $\frac{1}{4}$ " and  $\frac{1}{4}$ " down edge.



### Asbestos Ebony Accessories

**Asbestos Ebony Filler Compound:** Asbestos Ebony Filler Compound is a putty glaze for treating Asbestos Ebony surfaces which have been marred or scratched slightly. It is applied with a putty knife, fine sanded and lacquered.

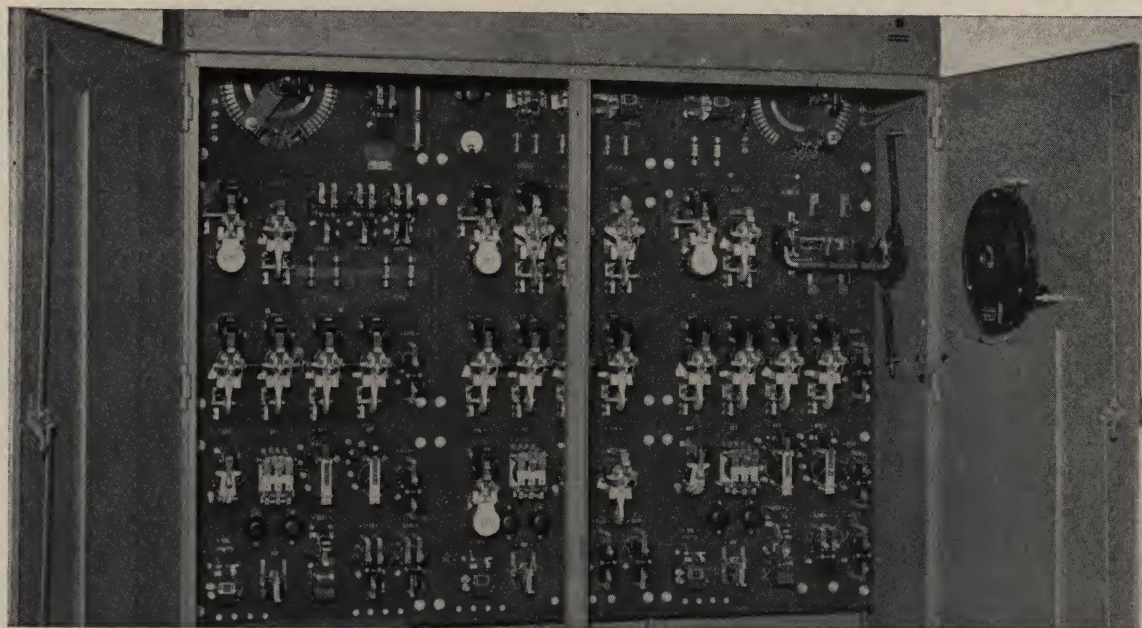
**Asbestos Ebony Filler Wax:** This material is used for filling deep pits, gouges or erroneous drillings. It is furnished in sticks and used much after the manner of sealing wax. First it is melted into the cavity and the excess scraped off to slightly below the panel surface. Then a glazing of Asbestos Ebony Filler Compound is applied and the rough spot fine sanded and lacquered with Asbestos Ebony Lacquer.

In the case of a sizable hole drilled through a thick panel, it is sometimes desirable to turn down an Asbestos Ebony plug to fill the opening, finishing up with a fine sanding, Asbestos Ebony Filler Compound and Lacquer.

**Asbestos Ebony Lacquer:** This material is used for lacquering Asbestos Ebony panels in the field. Asbestos Ebony Lacquer is mixed ready for use. Application should be made with spraying equipment. The covering capacity of the lacquer is approximately 300 sq ft per gallon.



## Ohmstone



*Ohmstone is readily drilled and machined to accommodate elaborate control equipment*

A companion material to Asbestos Ebony\*, Ohmstone\* is used primarily as a base material for switchboards, controller plates, switch bases, bus-bar supports, etc., which are used under unusually dusty conditions. Ohmstone has been specially developed for these conditions by incorporating unusual arc-resistance qualities in addition to its high electrical insulation strength.

Ohmstone is composed of asbestos fiber, cement, and a water repellent ingredient, bonded under pressure and impregnated with a non-carbonizing insulating compound. Ohmstone has a minimum arc-resistance of 230 seconds as tested under ASTM conditions. In addition to this high arc resistance, its dielectric strength is 38,000 volts for 1"-thick material.

Ohmstone weighs approximately 120 lb per cu ft. The safe working temperature limit is 175 F. The asbestos-cement base sheet will withstand much higher temperatures, but above 175 F the non-carbonizing insulating compound tends to ooze from the panel when subjected to this temperature for an extended period of time.

Metallic or carbon dust presents a special problem if it accumulates on the surface of an insulating

panel. If of sufficient density, it may form a conducting path between terminals and allow arcing across the face of the panel. Also, if the electric arc is of sufficient duration, the heat generated may tend to carbonize the surface. The special treatment given to Ohmstone enables it to resist this type of carbonization for a sustained period of time.

### *Physical and Electrical Properties, 1"-Thick Material*

Density, lb per cu ft, min . . . . .	120
Water Absorption, % dry wt, 48-hr immersion . . . . .	1.5
Modulus of Rupture, psi, min . . . . .	3800
Brinell Hardness, min-max . . . . .	17-40
Temperature limit, F . . . . .	175
Dielectric strength, volts . . . . .	38,000
Surface Resistance*, megohms, min . . . . .	30,000
Volume Resistance*, megohm in., min . . . . .	23,000
Arc Resistance, total sec-ave . . . . .	230

\* ASTM Spec D 257-46, after conditioning 24 hours at 50 RH, 100 F.

The principal fields for the use of Ohmstone are in steel mills, in mining equipment, and on many types of railway control apparatus. In these industries varying degrees of conductive dust generally are present and the arc resistant qualities of Ohmstone are particularly needed. As a mounting for switch gear and

\* Reg. U. S. Pat. Off.

### OHMSTONE

March, 1952 (Cancelling sheet dated October, 1949)

EL-10



control equipment, Ohmstone provides a suitable margin of safety in tension or compression with the ability to withstand shock and vibration that is inherent in a fibrous material. Its shock resistance permits its use with heavy automatic switches, relays, and circuit breakers.

Ohmstone is a permanent material. It will not rust, nor is it subject to rot or decay. Sudden temperature changes often encountered in electrical work from arcs or flashovers do not result in ruptures such as often occur in more brittle materials. Ohmstone remains uninjured after exposure to water, oil, gas and ordinary chemicals.

The machining operations necessary to prepare Ohmstone for erection or assembly are rapidly and easily accomplished.

### Finish

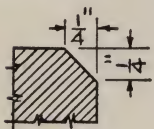
Ohmstone is regularly furnished with a fine, smooth surface, lacquered on one side in deep, everlasting black "switchboard" finish.

When required, as in the case of barriers, this same finish may also be obtained, at slight extra cost, on the reverse side of sheets which are  $\frac{1}{4}$ " thick or greater.

Although Ohmstone is regularly finished in lacquer, all thicknesses can be furnished unlacquered. There is, however, no allowance made for the omission of lacquer on sheets or panels.

### Bevels

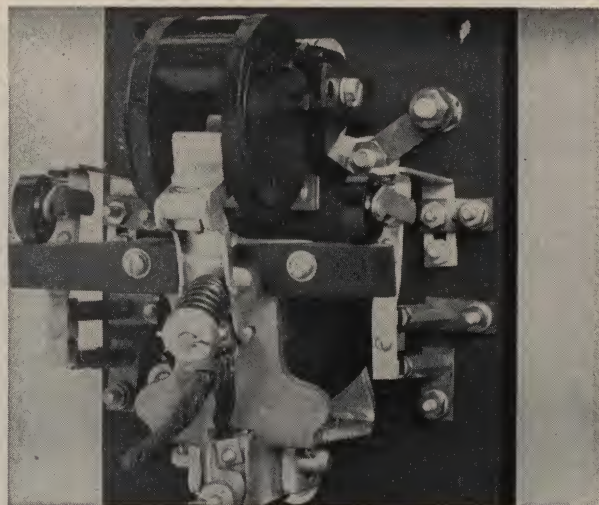
Any desired bevel may be furnished but bevels are usually  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ", or  $\frac{1}{2}$ ", with  $\frac{1}{4}$ " the most popular. Bevels are measured as per sketch; thus a  $\frac{1}{4}$ " bevel would have a projected measurement across face of panel of  $\frac{1}{4}$ " and  $\frac{1}{4}$ " down edge.



### Sizes and Weights

Thickness, inches	Sheet Sizes,* inches	Approximate Weight, lb per sq ft	
		Uncrated	Crated
$\frac{1}{4}$	42 x 96 42 x 48	2.6	3.0
$\frac{3}{8}$		4.0	4.5
$\frac{1}{2}$		5.3	6.0
$\frac{5}{8}$		6.8	7.5
$\frac{3}{4}$		7.9	9.0
1		10.6	12.0
$1\frac{1}{4}$		13.2	15.0
$1\frac{1}{2}$		15.8	18.0
2		21.1	24.0

\* Standard uncut sheets measure a fraction of an inch larger than nominal sizes given.  
Cut panels can be furnished within the size limitations of standard sheets. The tolerance allowed is  $\pm 1/32$ " on length and width.



*Ohmstone possesses good impact strength*

### Ohmstone Accessories

#### Filler Compound:

Asbestos Ebony Filler Compound is suitable for use on Ohmstone. It is a putty glaze for treating Ohmstone surfaces which have been marred or scratched slightly. It is applied with a putty knife, fine sanded and lacquered with Ohmstone Lacquer.

#### Filler Wax:

This material is used for filling deep pits, gouges or erroneous drillings. It is furnished in sticks and used much after the manner of sealing wax. First, it is melted into the cavity and the excess scraped off to slightly below the panel surface. Then a glazing of Asbestos Ebony (Ohmstone) Filler Compound is applied and the rough spot fine sanded and lacquered with Ohmstone Lacquer.

In the case of a sizable hole drilled through a thick panel, it is sometimes desirable to turn down an Ohmstone plug to fill the opening, finishing up with a fine sanding, Filler Compound and Lacquer.

#### Ohmstone Lacquer:

This material is used for lacquering Ohmstone panels in the field. Ohmstone Lacquer is mixed ready for use. Application should be made with spraying equipment. The covering capacity of the lacquer is approximately 300 sq ft per gallon.

Ohmstone and Ebony lacquer are not interchangeable. These two lacquers are made up from different types of material and are to be used only for the base sheet for which they are designed.



## Transite Asbestos Sheets

Flat Transite\* is a completely inorganic, structural sheet material which has a wide range of uses in the electrical industry. It is composed of asbestos fiber and portland cement, combined under great pressure into a homogeneous, dense mass having high strength and durability.

The unusual physical properties of Transite make it ideal for use where electrical apparatus are suitably insulated from the panel. Since flat Transite is not an electrical insulator like Asbestos Ebony\* or Ohmstone\*, it should not be used for direct mounting of current-carrying parts. The relative ease with which Transite can be machined and shaped makes it the natural choice for a panel material where the requirements call for physical strength and heat resistance.

In conjunction with J-M Trancell\* materials, flat Transite is widely used for building cell structures. For use with electrical equipment, it serves as a barrier between outdoor transformers, for cable trays and ducts, arc barriers or partitions, arc deflectors for controllers, and many other similar applications.

### Sizes and Handling

Flat Transite is furnished in large size sheets, or in smaller panel sizes, in the thicknesses from  $\frac{1}{4}$ " to 2". On special order, however,  $2\frac{1}{2}$ ", 3",  $3\frac{1}{2}$ " and 4" thicknesses can be obtained. See table following for details.

Transite can be readily handled by those users who operate their own cutting shop. The sheets can be machined, drilled with twist drills, and fastened with screws. A power-driven abrasive wheel or alloy-tipped metal saw should be used if much cutting is necessary.

### Finishes

The several finishes in which flat Transite is supplied are as follows:

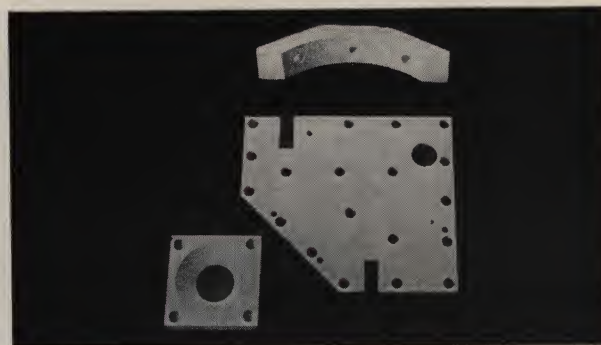
**Standard**—This is the usual finish required. It consists of one smooth surface formed by the press platen and a reverse surface of fine screen markings.

**Sanded One Side**—The platen surface is the same as Standard, but the screen marks on the reverse side are sanded off using about a number 20 paper.

**Sanded Two Sides**—With this finish, both faces are sanded with about a number 20 paper.

**Polished One Side**—The screen side is sanded very

\* Reg. U. S. Pat. Off.



*Special shapes, made from Flat Transite, can be furnished to meet individual specifications*

smooth, having a final belt sanding with about a number 150 paper. The platen side is not sanded.

**Polished Two Sides**—Both faces are sanded very smooth, having a final belt sanding with about a number 150 paper.

### Sheet Sizes and Thicknesses

Nominal Size, Inches	Thickness Inches (inclusive)	Nominal Size, Inches	Thickness Inches (inclusive)
36 x 48	$\frac{1}{4}$ to 2	48 x 48	$\frac{1}{4}$ to 2
42 x 48	$\frac{1}{4}$ to 2*	48 x 96	$\frac{1}{4}$ to 2
42 x 96	$\frac{1}{4}$ to 2	—	—

\*  $2\frac{1}{2}$ ", 3",  $3\frac{1}{2}$ " and 4" thicknesses on special order only.

### Thickness Tolerances

Type of Finish	Thickness, Inches	Tolerance, Inches
Standard	$\frac{1}{4}$ to $\frac{3}{4}$ $\frac{3}{4}$ and over	$\pm \frac{3}{64}$ $\pm \frac{1}{16}$
Sanded or Polished, One Side	All thicknesses	$\pm \frac{1}{16}$ *
Sanded or Polished, Two Sides	$\frac{1}{4}$ to $\frac{3}{4}$ $\frac{3}{4}$ and over	$\pm \frac{1}{32}$ ** $\pm \frac{3}{64}$ **

\*  $\pm \frac{1}{32}$ " on pieces 12" x 96" or less in length or width.

\*\*  $\pm \frac{1}{64}$ " on pieces 12" x 96" or less in length or width.

Flat Transite sheets may be curved in manufacture in any one direction, with a minimum radius of curvature depending upon the sheet thickness. Such sheets are curved and made available only on special order and at extra cost.

Untrimmed sheet sizes are somewhat greater in length and width than the dimensions given in the preceding table. These slightly oversized sheets will be furnished unless it is specified to trim the sheets to nominal size. All trimmed sheets and panels will have a tolerance of  $\pm \frac{1}{32}$ " on both length and width. Some



users who do their own fabricating prefer to have sheets with only one long and one short side trimmed so as to form an accurate 90-deg included angle. This will be done on request.

#### Physical Characteristics, 1"-Thick Material

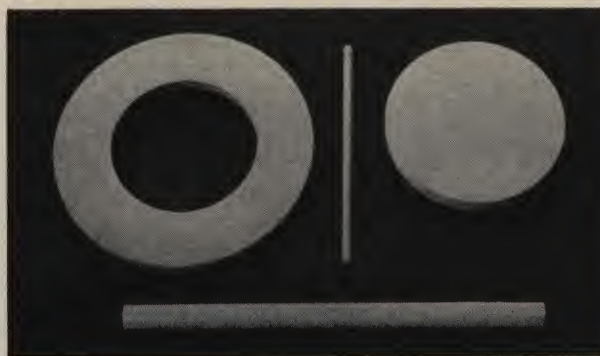
Density, lb per cu ft, minimum . . . . .	95
Modulus of Rupture, psi, minimum . . . . .	3,500
Compressive strength, psi . . . . .	12,000
Brinell Hardness	
500 kg load, 10 mm ball, 10 sec . . . . .	17-40
Temperature Limit, F . . . . .	600
Thermal Expansion, in. per in. per F . . . . .	0.000005

#### Thickness and Weights of Flat Transite

Thick- nesses, inches	Approximate weights in lb per sq ft	
	Unrated Sheets	Crated Sheets
$\frac{1}{4}$	2.7	3.1
$\frac{5}{16}$	3.3	3.9
$\frac{3}{8}$	4.0	4.6
$\frac{1}{2}$	5.2	6.0
$\frac{5}{8}$	6.5	7.5
$\frac{3}{4}$	7.8	9.1
$\frac{7}{8}$	9.0	10.4
1	10.3	12.3
1 $\frac{1}{4}$	12.2	14.2
1 $\frac{1}{2}$	14.6	18.0
1 $\frac{3}{4}$	17.0	20.5
2	19.4	23.0

For those users who do not possess fabricating equipment, panels and special shapes such as rings, discs, and rods are furnished to individual specification.

Discs and rings are furnished in all standard thicknesses. The outside diameter is limited only by the dimensions of the nominal size sheet from which they



Unusual shapes such as rings, rods and discs can be readily fabricated from Flat Transite

are cut. Rods are furnished in diameters from  $\frac{3}{16}$ " to  $3\frac{1}{2}$ " inclusive. Maximum lengths vary with the diameter as follows:

Diameter, Inches	Length, Inches	Diameter, Inches	Length, Inches
$\frac{3}{16}$	4	$\frac{1}{2}$ to $1\frac{1}{4}$	15
$\frac{1}{4}$ and $\frac{5}{16}$	8	$1\frac{1}{2}$ and $1\frac{3}{4}$	18
$\frac{3}{8}$	12	2 to $3\frac{1}{2}$	24

#### Painting and Cleaning

If Transite is to be painted, it should be given coatings of chlorinated rubber paints or a priming coat of boiled linseed oil and two coats of a good exterior paint. Pencil marks on Transite can be removed with art gum or sand paper.

Complete painting directions and further cleaning instructions are given on data sheet titled "Painting and Removing Stains from Asbestos-Cement Products."

## Transite Cable Trays

Since control cables in power houses must be readily accessible, an open type of supporting construction is essential. In the past, a common type of structure consisted of flat Transite sheets bolted to two steel angles, thus forming a trough or a tray. The cable capacity depended upon the height of the two side angles and the deflection of the trays under load. This type of construction necessitated galvanized or painted steel angles, with the result that assembly and maintenance costs were considerable factors.

In order to realize the full value of Transite as an incombustible, mechanically strong and corrosion-resistant material for this type of work, Johns-Manville developed a cable tray which eliminates entirely all steel work from the construction of the tray itself.

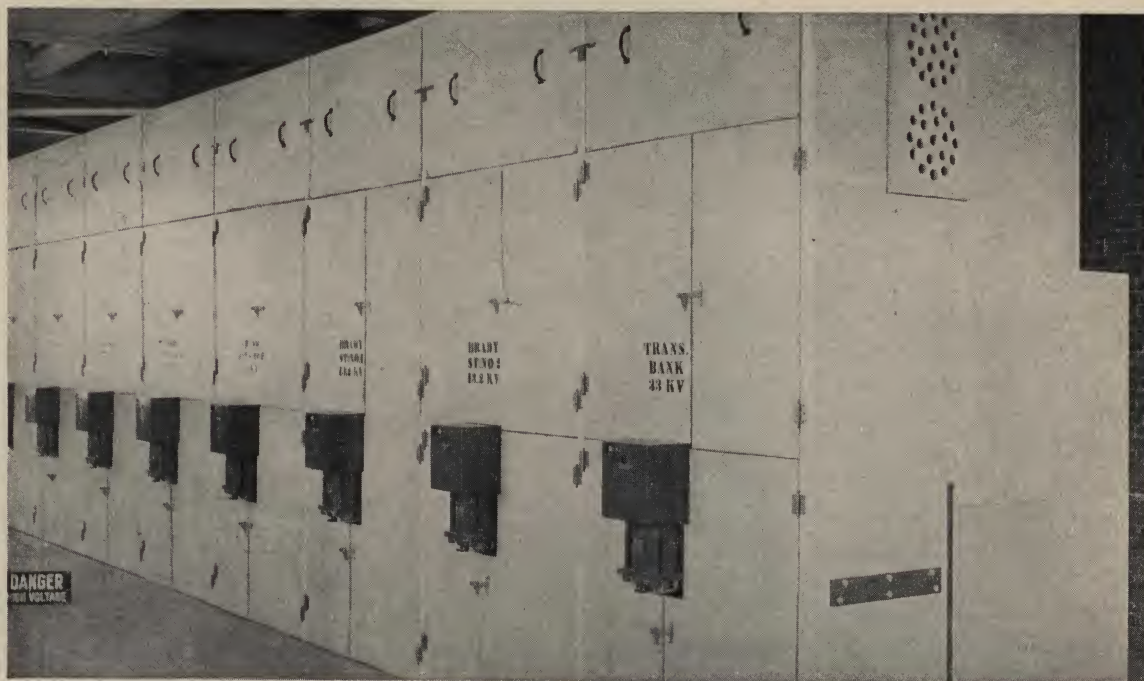
Transite Cable Trays are designed for the support of control cables for oil circuit breakers, disconnect switches, potential transformers and low capacity power cables. Their use assures a saving in space, lower installation cost, greater accessibility and no maintenance charges for the trays.

The tray itself consists of an integral unit of Transite with flat bottom surface and sides curved to a specified radius and height. A typical construction for Transite Cable Trays consists of a number of trays, in tier fashion, supported on brackets fastened to the side walls of the cable tunnel. The cable reels are rolled down the aisle between the cable tray tiers and the cables lifted into the trays.

Transite Cable Trays are also used in underground work for supporting cables in transformer vaults.



## J-M Trancell Materials for housing electrical equipment



*Supplied in large, ready-to-use sheets, J-M Trancell Materials are rapidly installed at low cost*

Cell structures must do more than provide a satisfactory means for installing electrical equipment such as bus bars, transformers, disconnect switches and other high voltage apparatus. They must safeguard the station operators and prevent accidental contacts between phases, circuits or ground, as well as confine within restricted spaces the products of combustion or ionized gases which are generated either by fire or by electric arc.

In the construction of cell structures, sufficient strength is necessary in order to support the equipment and withstand the electrical stresses. The material employed must be workable in order to permit field cutting, drilling and bolting. This characteristic is important not only to facilitate erection and subsequent extensions but also to effect rapid repairs.

### Advantages of Trancell

The above absolute requirements are fulfilled when J-M Trancell is used. In addition, barriers and shelves of this material, though strong, are of minimum thickness; consequently, they conserve space. They are light in weight and thereby decrease the floor load.

Moreover, Trancell housings can be rapidly erected and the electrical equipment easily installed. This results in low cost field erection.

Frequently, concrete is used for parts of cell structures which must also act as supporting walls of the building. In such instances, and whenever concrete is used to house large circuit breakers and reactors, smaller barriers and shelves made of Trancell can be readily combined with this type of construction.

Cell structures which are self-supporting and are independent of concrete walls do not require reinforcement, but steel framing, if desired, can easily be applied to Trancell materials.

In the case of large reactors where heavy stresses are set up on short circuits, reinforcing constructed of non-magnetic metals should be used. For this work, shapes of aluminum alloy having about the same tensile strength as structural steel are utilized. Shapes such as I's, channels and angles are available.

Bus structures, housings for current and potential transformers, circuit breakers, mountings for disconnect switches and protection for cables are readily accommodated by the variety of types of Trancell mate-



rials. Brief descriptions of these products, together with sizes and thicknesses, are listed on the next page.

The segregation and mounting of bus bars have always been difficult and expensive operations. Trancell is especially adaptable for this type of service because it is light in weight, conserves space, is comparatively inexpensive, easily erected and permits the installation of the bus bar support without difficulty. To facilitate inspection, removable Trancell covers or doors are available. They are described on data sheet, "Trancell M Doors."

Certain types of cell structures require painting and repainting to prevent corrosion. However, painting for this purpose is not necessary on housings constructed of Trancell. In its natural state, a light gray in color, Trancell is attractive in appearance and there is no cause for further finishing. Nevertheless, this material can readily be painted to match any desired decorative scheme.

Where Trancell is used for outside service or where unusual moisture conditions are present, it should be painted. In these instances, a good waterproof paint will prevent moisture absorption and protect the material. Trancell HW and LW, owing to their baked-on oil finish, do not require priming. This is also true of Trancell M. Transite and Trancell-X must be primed with boiled linseed oil.

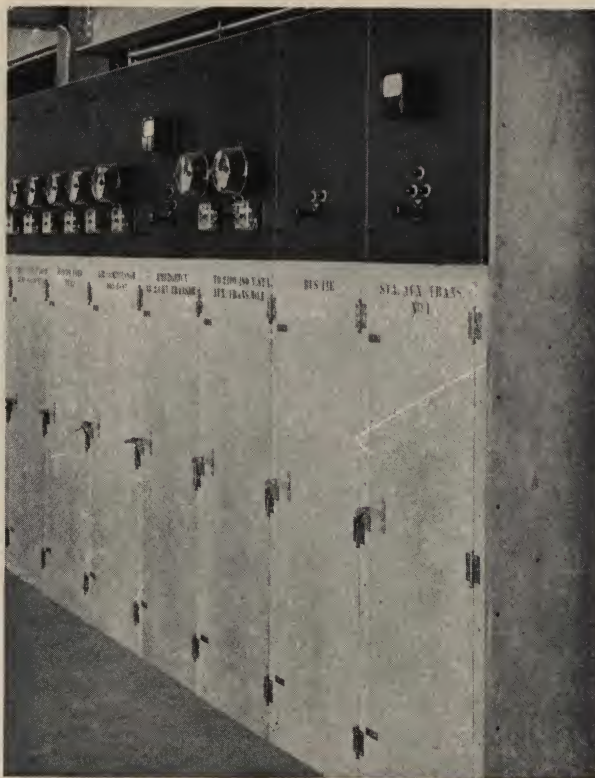
Condensation, a dangerous condition around electrical apparatus, is eliminated or decreased when Trancell is used to build housings.

### Erection of Trancell Materials

The toughness and resilience of Trancell materials are of great value in building a structure because these products will stand more abuse in handling than other materials used for similar service. The large size and relatively light weight of the slabs permit rapid erection which is further facilitated by the ease with which the material is cut and drilled.

Even though the prefabrication is carefully worked out, some trimming and cutting may be required on the job due to general inaccuracies in building construction. It is not wise to drill small bolt holes in the shop inasmuch as time and expense can be saved by field drilling. Drilling in the field can be done with a portable electric drill.

Cutting can be done with a carpenter's saw, but a light-weight electric saw does the work better, more quickly and with less effort. Experience, however, indicates that an abrasive disc secures the best results.



*Tough and durable, Trancell cannot rust or rot and requires little or no maintenance. Together with the instrument panel of J-M Asbestos Ebony, it was used to construct this neat and workmanlike housing*

Housings can be made gas-tight by sealing the joints with Trancell Cement.\* The appearance of the structures may also be enhanced by covering the countersunk screw heads with this material.

To assist in field work, detail drawings can be furnished. In such cases, key numbers are marked on the pieces shown on the assembly drawings and the same number stencilled on the materials. All crates are numbered and packing lists supplied showing the material in each crate. This saves considerable time and labor in erection.

Although Johns-Manville can cut material to special dimensions, many utilities have their own maintenance departments do the cutting. When the sheet material is cut to size on the job, slight size variations can be more easily made. Furthermore, only a minimum of equipment need be shut down at one time while the housing is built. By cutting Trancell at their plants, the utilities eliminate the necessity for numerous detail drawings and they can utilize the Trancell cut-offs.

\*Trancell Cement, the color of which blends well with Trancell-X and Transite, is supplied in pint, quart, ½-gal and 1-gal cans. This putty-like substance also adheres to masonry, wood and metals. Weight, 16 lb per gal.



*Types of Trancell Materials*

Designation	Description *	Size, inches	Overall thickness, inches
<b>Transite</b>	Asbestos fiber and cement weighing 124 lb per cu ft.	36 x 48, 42 x 48 42 x 96, 48 x 48 48 x 96	$\frac{1}{4}$ to 2
<b>Trancell HW</b>	Asbestos fiber and inorganic binder weighing 70 lb per cu ft. Sanded, plain or oil finish, baked, and sanded again.	36 x 96, 42 x 96 48 x 96	$\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1 $1\frac{1}{4}$ , $1\frac{1}{2}$ , $1\frac{3}{4}$ , 2
<b>Trancell LW</b>	Asbestos fiber and inorganic binder weighing 36 lb per cu ft. Sanded, plain or oil finish, baked, and sanded again.	36 x 96, 42 x 96 48 x 96	$\frac{1}{2}$ , $\frac{3}{4}$ , $\frac{7}{8}$ , 1
<b>Trancell WC</b>	Asbestos fiber and cement weighing 106 lb per cu ft. Normal cure.	48 x 96, 48 x 48	$\frac{1}{8}$ , $\frac{3}{16}$
<b>Trancell X</b>	Similar to Transite WC with different fibre content and cure. Same weight but stronger and less flexible.	48 x 96, 48 x 48	$\frac{1}{8}$ , $\frac{3}{16}$
<b>Trancell HW2X</b>	Trancell HW with $\frac{1}{8}$ " Trancell-X sheets cemented to each side.	36 x 96, 42 x 96 48 x 96	$\frac{3}{4}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$ , $1\frac{1}{2}$ $1\frac{3}{4}$ , 2, $2\frac{1}{4}$
<b>Trancell LW2X</b>	Trancell LW with $\frac{1}{8}$ " Trancell-X sheets cemented to each side.	36 x 96, 42 x 96 48 x 96	$\frac{3}{4}$ , 1, $1\frac{1}{8}$ , $1\frac{1}{4}$
<b>Trancell M</b>	A $\frac{1}{2}$ " core of Trancell LW with $\frac{1}{8}$ " Trancell-X cemented to each side. Sides and edges are coated with a clear, waterproof lacquer. Weight 4 lb per sq ft.	36 x 48, 36 x 96 42 x 48, 42 x 96 48 x 48, 48 x 96	$\frac{3}{4}$

\* Net weights given are approximate; for shipping weights, add 12 percent.

**Trancell Compared with Other Materials**

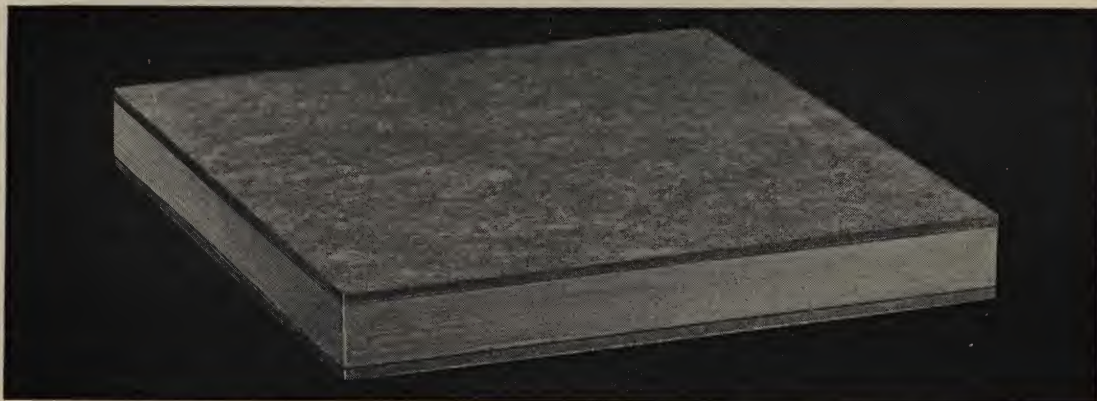
Monolithic cell structures, cast in place in the field, do not offer the advantages of units which are fabricated in the shop. Monolithic housings, to be sufficiently strong must be relatively thick and correspondingly heavy. The following paragraph, which compares the weights of concrete and Trancell barriers, makes this fact obvious.

Four inches is about the minimum practical thickness for cast slabs and the space occupied by such slabs represents a considerable percentage of the floor area taken by the cells. The weight per sq ft is about 50 lb, which makes a weight of 1000 lb for a barrier  $2\frac{1}{2}$ -ft wide by 8-ft high. A barrier the same size of  $1\frac{3}{4}$ "-thick Trancell HW2X would weigh only 245 lb.

This represents a saving of 56 percent in space and a reduction of 75 percent in weight. Barriers of  $\frac{1}{2}$ "-thick Trancell LW, the lightest of the materials, can be furnished weighing only 1.8 lb per sq ft.

Form work necessary for casting monolithic structures is a cabinet maker's job requiring skilled labor, much lumber and considerable time to build. Where a station is in operation, the mixing and pouring of concrete are not only difficult but also hazardous.

With this type of structure, it is necessary to set inserts by use of templates or drill for expansion shields. These operations increase the time and cost involved in installing electrical equipment. Moreover, repairs are difficult and expensive.



*Trancell HW2X, cut from a large sheet, showing the facing of Trancell-X on each side*

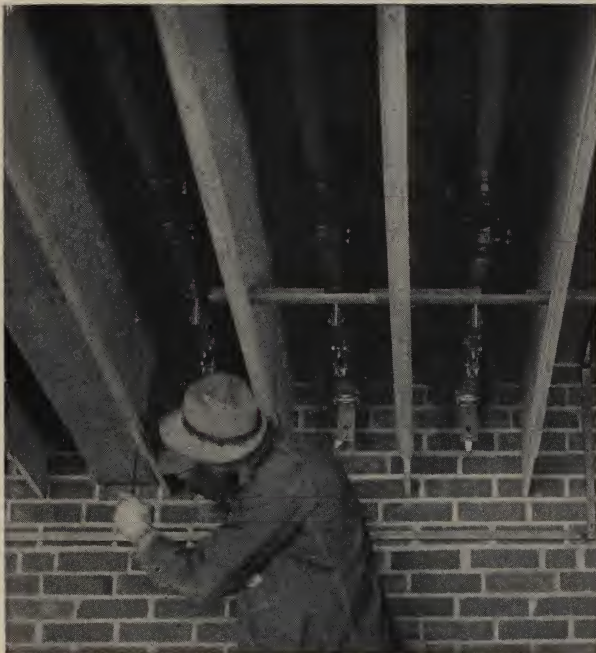


Many of the considerations noted previously apply to the use of bulky, molded materials which are commonly employed in building construction. When used in cell structures, their great weight and bulk, together with the expense of erection and inconvenience of installing electrical equipment, only serve to emphasize the desirability of light-weight fabricated units which eliminate these objections.

Easily worked Trancell, which is also comparatively light in weight, offers many advantages in housing electrical equipment not found in the other types of products mentioned. This is further borne out by experience gained on actual installations during the past decade. For genuine flexibility and for economy of materials and labor of erection, the various J-M Trancell products are unqualifiedly recommended.

## Typical Trancell Constructions

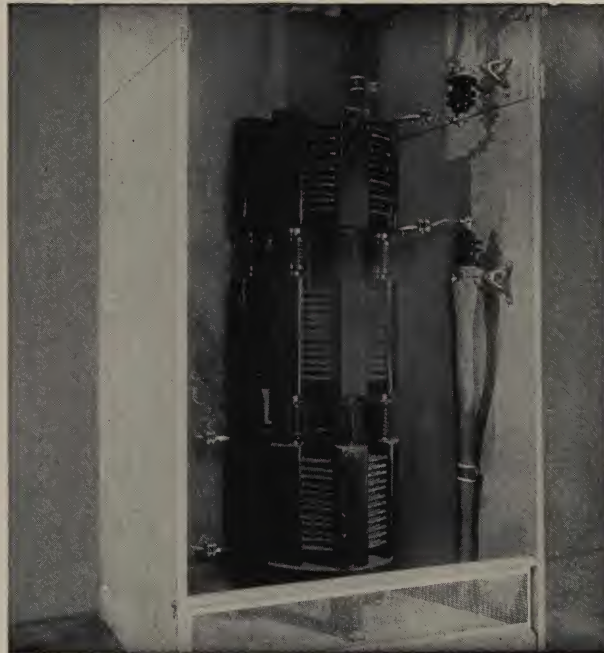
The following photographs illustrate how neatly and adequately Trancell structures may house various units. They also indicate simplicity of construction. This characteristic can be more fully appreciated, however, by knowing the types of Trancell used and the manner of its erection.



The above photograph illustrates the method of enclosing bus bars supported from the ceiling with Trancell materials. Trancell LW2X,  $\frac{3}{4}$ " thick, is fastened to the ceiling by means of clip angles attached to the concrete with expansion bolts. No inserts or other fastening devices are required because of this material's light weight.

Because it is thin, the Trancell used to house this apparatus conserves space; yet this material is considerably stronger than the same thickness of a cement-asbestos sheet. As a result of the Trancell being light in weight and easy to handle, this structure was easily and rapidly erected by a small crew of workmen.

The completed housing includes Trancell M doors hung from the barriers, permitting access to each compartment. Complete enclosure plus the fact that Trancell is fireproof protects the bus bars against fire.



Trancell materials are especially adapted for housing reactors because they eliminate the possibility of heavy induced currents being set up within them. The material used to house above three phase reactor is  $1\frac{1}{2}$ "-thick Trancell HW2X. Side walls are 5 ft 6" wide by 10-ft high. The left wall has a splined joint; on the right, battens are used for joining.

Where single phase reactors are mounted above each other, they can be placed on shelves which, if necessary, can be structurally reinforced without encountering electrical difficulties.

The two doors, not shown, for this enclosure are 8 ft by 2 ft  $7\frac{3}{4}$ " and are manufactured of Trancell M. They are hung from structural angles which are attached to the side walls. In this construction, a space is provided above and below the doors for ventilation; the bottom area is shown fitted with a metal grille.

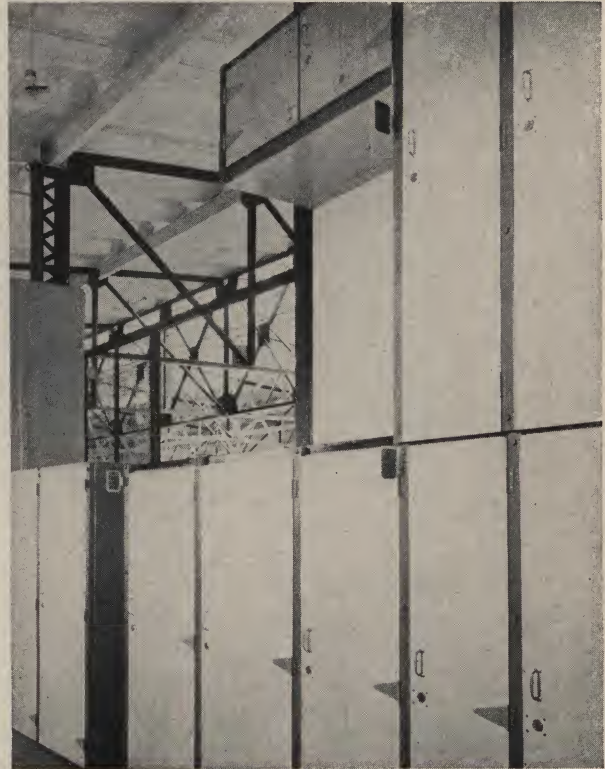


## Trancell M Doors for use on cell structures

In order to protect the apparatus fully and to safeguard the station operators, electrical equipment is usually completely housed. However, since repairs and frequent inspections necessitate access to the equipment, doors are an essential part of cell construction. These doors, to give adequate service, must be strong, free from warpage, light in weight and must resist severe shock and station fires.

Before Trancell M doors completely met these requirements, other methods of cell door construction were used consisting of Transite panels with rails and stiles. The shortcomings of this type of door were that the framework, even when made of fireproofed wood, did not resist flame; consequently, the panel which formed the barrier became detached. To correct this defect, many doors are now made with unburnable Transite stiles and rails. Though this type of door is satisfactory from the standpoint of being fireproof and strong, it is not entirely free from warpage. Moreover, doors with Transite frames are expensive to make as special shop equipment is needed for fabrication.

Regardless of the materials used for cell doors with stiles and rails, considerable hardware is required



*No framing or reinforcement is required on these simply constructed doors. The hardware is mounted directly on the Trancell M sheets*



*Where visual control of electrical equipment is necessary, it can be achieved by a cutout in the door into which a frame and glass window can be inserted*

such as reinforcing plates at frame joinings and metal binders around the edges. Besides adding to the cost of construction, this hardware is frequently difficult to obtain and is often the cause of delayed operations.

### Advantages of Trancell M Doors

Because of the inadequacy of doors with frames, Johns-Manville designed Trancell M doors which are much simpler in construction. They consist merely of a sheet of Trancell M, cut to size, with the necessary hardware fastened to it. The result is a cell door which is strong and light in weight and which affords excellent protection. In addition, this door has little tendency to warp and is attractive in appearance.

Trancell M is easily cut and drilled with ordinary shop equipment. After a door is cut to size from the sheet metal, the only finishing required is mount-



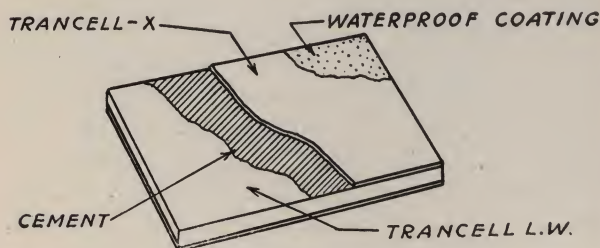


*Ventilation is secured by use of metal grids similar to those in these hinged doors*

ing, directly on the panel, the handles, latch, hangers or hinges and metal protectors on the bottom corners. Stiles, rails, metal trim and other reinforcements are not used in the construction of these cell doors because of the unusual characteristics of the sheet material

### Description of Trancell M

Trancell M, a ply material, is made with a center of Trancell L. W. which is a  $\frac{1}{2}$ " thick monolithic sheet of compressed asbestos fiber and an inorganic binder. Cemented to both sides of the core are  $\frac{1}{8}$ "-thick sheets of Trancell-X, a dense material made from asbestos fiber and cement. The multiple-layer construction of Trancell M results in a strong sheet and reduces warping to a minimum. This action is further lessened by a coating of waterproof lacquer on the sides and edges. An additional supply of this lacquer may be obtained in quart,  $\frac{1}{2}$  and 1-gal containers.



*Structure of Trancell M*

Laboratory tests of Trancell M reveal the following information on these important physical characteristics.

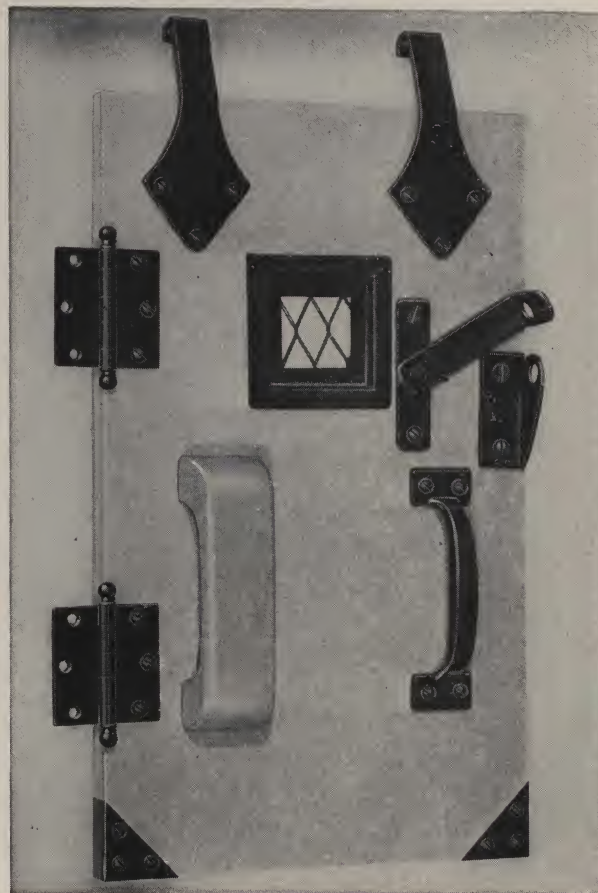
Weight per sq ft . . . . .	4.0 lb
Modulus of rupture . . . . .	4500 lb per sq in
Breaking load on 36" span per foot of width (uniform loading) . . . . .	1136 lb
Breaking load as a 42" high column per inch of width . . . . .	3600 lb
Shear per sq in . . . . .	1560 lb
Modulus of elasticity . . . . .	2,220,000

Sizes of sheets are 36", 42" and 48" wide by 48" and 96" long and size 48" x 60". Standard thickness is  $\frac{3}{4}$ ".

### Hardware for Hanging and Ventilating

Trancell M doors may be installed with either steel hangers or hinges and with latches of standard design. Latches which can be padlocked are available and handles of wood or pressed steel can also be furnished.

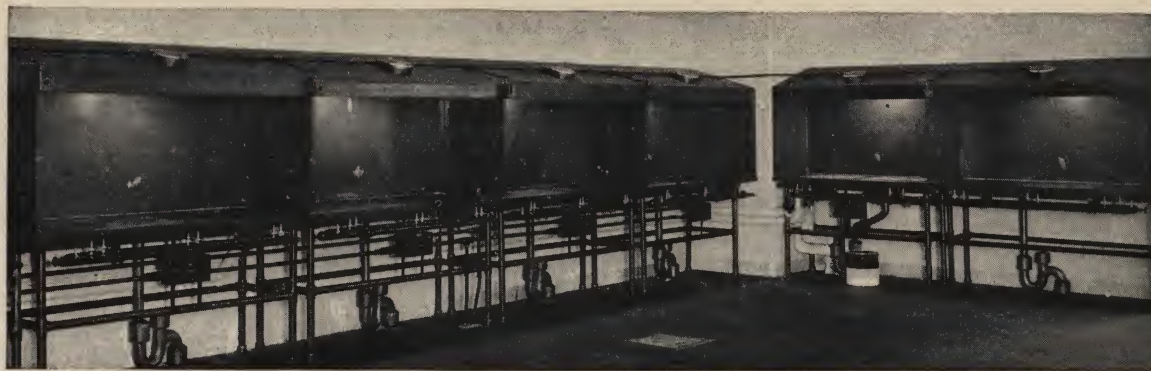
When ventilation is required, cutouts can be made in the doors, and metal frames with grids welded to them can be supplied. These grids are made of  $\frac{3}{4}$ " standard expanded metal, diamond mesh. If desired, frames can be obtained that will hold  $\frac{1}{4}$ "-thick glass.



*Panel showing standard hardware for Trancell M doors*



## Chemstone



*Corner of a chemical laboratory at a leading Eastern university, showing Chemstone fume hoods*

Chemstone\* is a tough monolithic material made from asbestos fiber, cement and inert mineral fillers, and integrally mixed with a water, acid and alkali-resisting compound. The material is then moulded under high pressure into homogeneous sheets which are dark brown in color.

This material possesses the unusual strength which is characteristic of asbestos-cement products. Even the thinnest sheets offer remarkable resistance to breaking, cracking, spalling and chipping. Yet Chemstone is relatively light in weight and is workable with regular shop tools. Neither special equipment nor technique is needed for its installation.

### *Physical Characteristics:*

A summary of the important physical characteristics of Chemstone includes:

Density (lb per cu ft): approximately .....	105.0
Modulus of rupture (psi, minimum): $\frac{1}{4}$ " to $\frac{3}{4}$ ", inclusive .....	3500
$\frac{3}{4}$ " to $1\frac{1}{4}$ ", inclusive .....	3000
Brinnell hardness: 500 kg on 10 mm ball.....	10-20
Water absorption (maximum, percent): 48 hours immersion at room temperature.....	3.5
Temperature limit:.....	600 F

The transverse strength of Chemstone permits the use of large sheets which, of course, effect important erection economies and reduce to a minimum the necessary number of joints. The strength of the material, moreover, permits the use of thinner sheets where otherwise much heavier units would be required, and also eliminates the need for excessive

\* Reg. U. S. Pat. Off.

framing or bracing. Also, because of its fibrous nature, Chemstone is highly resistant to damage by temperature or mechanical shock.

### *Chemical Resistance:*

In general Chemstone is very resistant to a considerable number of the chemicals encountered in the laboratory and industrial plant. Its life, however, like that of any other material used under corrosive conditions, depends upon the numerous variables encountered in service. Consequently, a very accurate statement of the resistance of any such material is almost impossible.

Since concentration of a corrosive solution, temperature, pressure and other variables must be taken into account, an indication that Chemstone is affected does not necessarily eliminate it from consideration for a specific purpose. For certain uses Chemstone may prove to be the most economical material, even though attacked, if it will last longer than any other material available at the same installed cost. The most satisfactory test is made by the use of a sample of the material under actual service conditions.

### *Finishes:*

Chemstone is available in four types of finish: No. 1, rough drum sanded with No. 20 paper, has a dark brown color and a fairly rough surface. This finish is satisfactory where service and durability are the prime considerations. Finish No. 2, sanded with No. 80 paper, provides a surface smoother than No. 1. The other finishes available are No. 3, which is belt-sanded with three papers (No. 80, 100 and 120) and provides a very smooth surface; and No. 4, which has the same





*A large laboratory equipment manufacturer supplied these Chemstone table tops, with a glossy chemical resisting finish as part of the completely fabricated units for this chemical laboratory*

sanding as No. 3, but is glazed and polished in addition.

The proper maintenance of Chemstone depends upon the type of finish or coating. Although finishes No. 1 and No. 2 can be washed with soap and water, cleaning for No. 3 and No. 4 should be restricted to rubbing with a dry dust cloth or No. 400 sandpaper. An application of a hard wax over finishes No. 3 and No. 4 provides added protection and improved appearance.

### Uses of Chemstone

#### Table Tops:

Chemstone is primarily used for table tops. Where service conditions are not severe, Chemstone tops with a No. 3 or No. 4 finish will give long service. Where

more severe conditions are present, a protective chemical resistant coating should be applied to the table top. These coatings can be either baked on or cold applied by brush or spray. Many of the leading laboratory equipment manufacturers apply a baked-on finish to the Chemstone tops. Johns-Manville is not equipped to apply such coatings.

#### Fume Hoods:

The physical properties of Chemstone and its chemical resistance provide an excellent material for constructing fume hoods. Because of the large size of the sheets, joints are reduced to a minimum. The high structural strength of Chemstone also permits the use of thin sheets, thereby reducing excessive weight and requiring fewer braces and supporting members.

#### Ducts:

Because Chemstone is a sturdy monolithic material moulded into homogeneous sheets, it lasts longer in service than other materials which are surface treated. Its longer life is an important consideration when cost estimates of duct systems are analyzed.

Replacement of short-lived materials is an expensive operation, inasmuch as installation expense represents a high percentage of the cost of most duct systems, especially when ducts are concealed or inaccessible.

The long service and desirable physical and chemical properties of Chemstone make it especially suitable as a duct material in chemical laboratories and in factories.

#### Standard Sheet Sizes:

Chemstone is furnished in sheets 24" x 96", 42" x 96" and 48" x 96" in thicknesses of  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1", and  $1\frac{1}{4}$ ".

Standard uncut sheets measure a fraction of an inch larger than nominal sizes listed above. When ordered to nominal sheet size, tolerance will be  $\pm \frac{1}{32}$ ". Chemstone in all finishes is furnished  $\pm \frac{3}{64}$ " in thicknesses  $\frac{1}{4}$ " to 1" inclusive, and  $\pm \frac{1}{16}$ " for  $1\frac{1}{4}$ " sheets.

## Chemstone Cement

Chemstone Cement is a black, waterproof, chemical-resisting material especially developed for use with Chemstone.

However, Chemstone Cement is also a good general utility joint material for chemical service. It is resistant to most classifications of chemicals. Coal tar solvents and highly solvent organic chemicals, however, should not be permitted to remain in contact with it for extended periods of time. Under severe organic

solvent conditions, the cement tends to soften, and eventually the bond will fail.

The cement has a consistency of a heavy putty. It may be applied at room temperature, and can be easily spread with a putty knife. The material weighs approximately 12 lb per gal, and when applied  $\frac{1}{32}$ " thick, has a coverage of approximately 4 sq ft per lb. When not in use, the cement should be kept tightly sealed in its container.



## Asbestos Ebony Moulded and Electrobestos

In many industries the introduction of moulded shapes has simplified the assembly of units and effected important production economies. Two such custom-moulded materials which have wide adaptability are Asbestos Ebony Moulded and Electrobestos. Asbestos Ebony Moulded is primarily an electrical insulation. Electrobestos is most commonly used where high heat resistance is needed. Both materials afford considerable saving, especially when thick, heavy pieces of simple design are involved.

### Asbestos Ebony Moulded

Asbestos Ebony Moulded is an excellent electrical insulation which is extensively used, principally where small panels, bases or plates are required for switches, starters, meters and similar units. It is black in color and makes a very presentable appearance.

The material is formed under heavy pressure from a mixture of asbestos fibre and binding cement and is impregnated with a special insulating compound. The finished product is electrically and mechanically strong. It will not absorb moisture nor deteriorate with age, and it will successfully withstand the action of ordinary laboratory acids. The material is suitable for working temperatures up to 300 deg. F.

### Electrobestos

Electrobestos is a greyish-white material which is widely used for arc or flame barriers and for parts of small ovens, muffles, or other apparatus exposed to heat. This material, however, is not recommended for the mounting of current carrying parts.

Two kinds of Electrobestos are available. Where a material combining moderate structural strength



*Asbestos Ebony Moulded parts used in electrical service*

with great adaptability to temperature changes is required, plain Electrobestos should be specified. Electrobestos-X, a slightly harder material, possesses greater structural strength, but offers slightly less resistance to the stress of expansion and contraction under sudden temperature changes.

Electrobestos is composed of asbestos fibre and high temperature clays moulded to shape in a cold plastic mass, impregnated with a liquid binder and heat treated. It has been used in many applications under steady or intermittent heat up to 1200 deg. F.

**Sheets:** Electrobestos is available in sheet form, up to 30" x 30", in thicknesses of  $\frac{1}{4}$ " to  $1\frac{1}{2}$ " inclusive. Sheet Electrobestos is made by a slightly different process than that used for moulded shapes and consequently varies from them in some properties. Its heat resistance is approximately 800 deg F. (Note: Electrobestos-X is not furnished in sheet form.)

**Muffle Furnace Trays:** Where enameling or vitrifying processes are carried on in muffle furnaces, the use of Electrobestos trays usually shows a saving. The trays can be furnished to size up to 30" x 30".

**Panels:** Holes, slots, grooves, bosses and characters can be inexpensively included on panels. Dimensions are shown under "Design Possibilities."

**Arc Deflectors:** Its high resistance to the deteriorating effects of constantly arcing contacts makes Electrobestos eminently suitable for use in the form of arc deflectors. Moulds for many styles of deflector plates are carried in stock. Special shapes can be furnished from blueprint or model.



*A few of the many moulded pieces made of Electrobestos*



**Heating Appliances:** Small furnaces and ovens may be inexpensively moulded of Electrobestos. In such appliances Electrobestos often provides in the walls sufficient insulation to obviate the need for an additional material.

**Soldering Cups:** Cups, such as used by dentists, are available in two sizes:  $4\frac{5}{8}$ " o.d. x  $1\frac{7}{8}$ " high with a  $3\frac{1}{2}$ "-dia. x 1"-deep depression and  $3\frac{1}{2}$ " o.d. x  $1\frac{1}{8}$ " high with a  $2\frac{3}{4}$ "-dia. x  $2\frac{1}{32}$ "-deep depression.

**Furnace Bushings:** Bushings of the Ajax-Wyatt Induction Furnace type are available in three sizes: 11" i.d. x 12" o.d. x 16" long;  $13\frac{1}{2}$ " i.d. x  $14\frac{1}{2}$ " o.d. x 18" long; and  $13\frac{5}{8}$ " i.d. x  $14\frac{5}{8}$ " o.d. x 21" long.

**Stove Pipe Insulators:** These cylindrical pieces of Electrobestos, when interposed between lengths of metal stove pipe, afford an effective barrier to the transmission of accidental electrical currents through the pipe. Moulds are available for  $6\frac{3}{4}$ " sections to fit 4", 5" and 6"-dia. pipe.

### Design Possibilities

Special moulded shapes of Asbestos Ebony Moulded and Electrobestos can be furnished within the following maximum dimensions:

Thickness	Square Pieces	Oblong Pieces
$\frac{1}{4}$ "	6" x 6"	6" x 6"
$\frac{3}{8}$ "	8" x 8"	8" x 8"
$\frac{1}{2}$ "	12" x 12"	12" x 12"
$\frac{5}{8}$ "	12" x 12"	12" x 14"*
$\frac{3}{4}$ "	$15\frac{1}{2}$ " x $15\frac{1}{2}$ "*	15" x 16"*
1"	16" x 16"*	16" x 18"*

\* Furnished in Electrobestos-X and Asbestos Ebony Moulded only.

Thicknesses up to 2" can be furnished within the size limits indicated above. Thicker pieces can also be furnished in smaller areas, depending upon the intricacy of the design.

Unthreaded holes can be moulded to the correct size in the face of a panel; screws, when inserted, will cut their own thread. Lateral holes and recesses as well as spiral grooves or threads and threaded holes are impractical. If holes extend through a piece, a  $\frac{3}{32}$ " to  $\frac{1}{8}$ " wall must be provided between adjacent holes and between holes and the edge of the piece.

Bosses on the face or back of a panel usually require a draft one-half the height of the boss, but many bases and panels having raised sections over  $\frac{1}{4}$ " high may require only a slight draft.

Depressions or grooves may be made as deep as one-half the thickness of the piece. These require a draft of approximately one-half the depth. Shallow depressions should have walls at least  $\frac{1}{8}$ " thick.

The walls of moderate size pieces and box or box-cover shapes should be at least  $\frac{1}{4}$ " thick.

Metal inserts may be moulded into Asbestos Ebony Moulded panels, except at the edges. Where inserts at the edges are required, holes may be drilled and tapped to provide for them. As a rule, inserts cannot be moulded into Electrobestos, but occasionally it is possible. In some cases the inserts can be cemented into the finished piece.

A tolerance of  $\pm \frac{1}{64}$ " must be allowed on practically all pieces, and in many cases an allowance of  $\pm \frac{1}{32}$ " is necessary because of the design.

Name plates, numbers or letters are usually moulded as raised characters in a sunken panel. The tops of the characters are  $\frac{1}{64}$ " below the surface of the panel to permit sanding or finishing without injury to them. Depressed characters can also be formed, but usually at extra cost. Raised characters without a sunken panel may be specified, but are usually not considered practical. Characters may be placed on the face or back of any moulded piece, or, if the design of the piece is suitable, on both front and back or at opposite edges. Such impressions, however, can be made only on parallel faces.

Rounded corners can in many cases be moulded as easily as square ones. In straight panels a  $\frac{1}{16}$ " round corner may be put on in finishing at slight cost. Bevels may be moulded on either four or eight edges, except in the case of irregular surfaces.

In testing to determine the properties of a moulded shape, sheet material should not be used. Moulded specimens, as close as possible to a contemplated design, can be furnished for such purposes.

### Information Required for Quotations

Asbestos Ebony Moulded and Electrobestos shapes can be made from blueprints unless a complicated piece is desired. In such cases a model of the part should be submitted. Data relative to mechanical and electrical stresses, temperature and chemical conditions, and daily requirements are also required.



# Niagrite-Asbestoment Cable Fireproofing

The usual electrical cable insulation and lead sheath are easily damaged by excessive heat and, when exposed to an electric arc, are quickly destroyed. Where cables are closely grouped in manholes and vaults, serious service interruptions and costly cable repairs due to burnouts and fires can be avoided only through the use of adequate fireproof protection. Such protection is provided by Niagrite-Asbestoment®—an inexpensive, easily applied combination of materials.

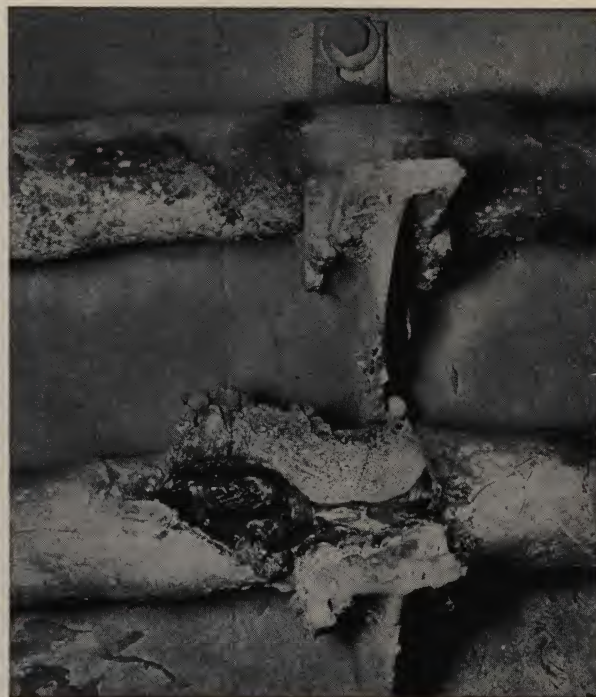
The Niagrite-Asbestoment combination consists of an outer refractory coating, which resists the shock of an impinging arc, and a soft inner felt wrapping, which protects the cable from the heat of arcs and manhole fires. The felt wrapping, moreover, provides a cushion which protects the outer coating against cracks both while it is setting and afterward when the cable expands and contracts under changing loads. While nothing can save an arcing conductor, the use of Niagrite-Asbestoment renders adjacent cables reasonably secure from communicated damage. And in the event of a manhole fire, this fireproof combination effectively retards the transfer of excessive heat to the cables. Although especially designed as a cable fireproofing, Niagrite-Asbestoment also affords considerable protection against mechanical injury to cables in exposed locations.

## Advantages of Niagrite-Asbestoment:

The advantages and characteristics of Niagrite-Asbestoment may be briefly summarized as follows:

1. High resistance to the disastrous effects of an arc. Niagrite-Asbestoment offers far greater protection than an equal thickness of a cement-and-sand mixture over muslin or manila rope.
2. High resistance to the heat of manhole fires. Yet the thermal conductivity is adequate to dissipate conductor heat satisfactorily.
3. Withstands immersion, constant or intermittent, without effect on the fireproofing. The coating absorbs and holds a moderate amount of moisture without effect on either Niagrite or Asbestoment.
4. Flexibility. The Niagrite permits cable expansion and contraction, due to changing loads, without causing the Asbestoment to crack or fall off.
5. Virtually no effect on cable sheath. A soft asbestos felt protects the lead sheath. Moreover, all materials used are of low alkalinity. A paraffined cloth or asphalted wrapper need not be used except in areas where the ground water is known to be corrosive.
6. Ease and economy of application. Unskilled crews quickly learn to apply the materials rapidly.

In addition to these advantages, the Niagrite-Asbestoment combination is inexpensive and durable.



*The value of cable fireproofing is vividly demonstrated in this failure of an 11,000-volt line. Adjacent cables were not destroyed. Also, note fusion of cast-iron bracket and porcelain cable saddle*

## Niagrite

Niagrite is commercially pure asbestos felted tape, applied in widths of 1½", 2" and 3" and in thicknesses of ⅛" and ⅜". Unless otherwise ordered, 15-ft rolls will be supplied. Niagrite is furnished in the following four types: Niagrite A, backed with cloth; Niagrite B, backed with burlap; Niagrite C and D, without backing.

Niagrite D is not as high in quality as the other types and, especially when wet, is not as flexible or strong. Niagrite D is supplied only in ⅛" thickness, 2" or 3" wide. The type most generally selected is Niagrite B, which combines strength with economy.

A thickness of at least two ⅛" layers of Niagrite is recommended; the width should approximate the diameter of the cable.

## Asbestoment S

Asbestoment S is an efficient refractory material furnished in powder form in 100-lb bags. Mixed with water, it is applied as an outer protective coating over

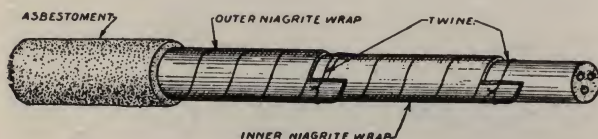


the Niagrite to a thickness of approximately  $\frac{1}{2}$ ", or at least  $\frac{3}{8}$ ". The material weighs 70 lb per cu ft, dry. The coverage, 1" thick per 100 lb, is 12 sq ft. Asbestoment S possesses high arc resistance, excellent work-

ability and adhesive qualities. It is very low in alkalinity, not nearly as alkaline as cement and sand, and can be mixed in not particularly clean utensils since it is not sensitive to contamination.

## Application of Niagrite-Asbestoment

To apply Niagrite, the paper wrapper is removed. The coil is then loosened and submerged in water until it is pliable but not too wet. The wet felt is next wrapped helically on the cable.



For Niagrite A and B the starting and finishing laps of each roll are tied with heavy twine, each winding butted closely and the entire wrapping pulled tight. With Niagrite C and D the felt is wrapped without tension and bound with wrappings of twine. When expanded ends of a lead splicing sleeve are encountered, the wrapping method is varied to suit the contours of the sheath. Care, however, must be exercised to assure complete, snug coverage of the cable. A second layer is then applied so that joints occur midway between those of the first layer. When secured, the Niagrite is covered with Asbestoment.

Asbestoment is mixed like a neat cement, to about the consistency of a stiff mortar, and turned well until the batch is thoroughly wetted and works smoothly. The Asbestoment should be applied within one hour after mixing.

A very thin priming coat of Asbestoment is smeared onto and well rubbed into the wet Niagrite. If the Niagrite is too wet the Asbestoment will not adhere properly. Then a  $\frac{1}{2}$ " or  $\frac{3}{8}$ " layer of Asbestoment is applied. To produce a workmanlike finish, a small amount of water should be applied to the surface of the Asbestoment and finished with a trowel or rubber gloves.

Care must be exercised to see that the cable is covered to a uniform thickness. This can be accomplished through the use of a home-made metal gauge.

The following table of quantities includes two layers of Niagrite and a sufficient outer covering of Asbestoment to the thicknesses indicated in the column headings. Care should be taken to figure all splicing sleeves at the diameter of the sleeve and not that of the cable proper.

Quantities of Materials per 100 Feet of Cable

Linear Feet of Niagrite							Pounds of Asbestoment S					
OD of cable or sleeve, inches	1/8"-thick Niagrite			3/16-thick Niagrite			OD of covered cable or sleeve, inches	Per thicknesses given				
	1 1/2" W	2" W	3" W	1 1/2" W	2" W	3" W		1/4"	3/8"	1/2"	5/8"	3/4"
1	593	—	—	675	—	—	1 1/4	91	147	212	284	363
1 1/4	701	—	—	780	—	—	1 1/2	106	170	242	322	408
1 1/2	809	—	—	892	—	—	1 3/4	121	193	272	359	454
1 3/4	918	—	—	999	—	—	2	136	215	302	397	500
2	—	769	—	—	830	—	2 1/4	151	238	333	435	544
2 1/4	—	851	—	—	911	—	2 1/2	166	261	363	473	590
2 1/2	—	931	—	—	992	—	2 3/4	181	284	393	510	635
2 3/4	—	1012	—	—	1073	—	3	197	306	423	548	680
3	—	—	729	—	—	769	3 1/4	213	329	454	586	726
3 1/4	—	—	783	—	—	824	3 1/2	227	352	484	624	771
3 1/2	—	—	837	—	—	877	3 3/4	242	374	514	661	816
3 3/4	—	—	891	—	—	931	4	257	397	544	699	862
4	—	—	944	—	—	986	4 1/2	287	442	605	775	953
4 1/2	—	—	1053	—	—	1091	5	318	488	665	851	1043
5	—	—	1161	—	—	1201	5 1/2	348	533	726	926	1134
5 1/2	—	—	1268	—	—	1309	6	378	578	786	1002	1225
6	—	—	1376	—	—	1417	6 1/2	408	624	847	1077	1315
6 1/2	—	—	1485	—	—	1525	7	438	669	907	1153	1406
7	—	—	1593	—	—	1633	7 1/2	469	714	968	1228	1497
7 1/2	—	—	1700	—	—	1741	8	499	760	1028	1304	1588
8	—	—	1808	—	—	1849	8 1/2	529	805	1089	1380	1678



## J-M Sealing Compounds

J-M Sealing Compounds are plastic, putty-like materials designed for sealing operations of many kinds. Since no one type of compound can fully meet all the various sealing requirements, six are provided for such purposes: Uniseal\*, Duxseal\*, Navaseal, Pakseal, Tranolseal\*, and Nodrseal\*.

### Descriptions

The wide utility of J-M Sealing Compounds may be judged from the following descriptions:

#### *Uniseal (All-Purpose Sealing Compound):*

Uniseal is a non-slumping sealing compound for general purposes. It is low in water absorption and vapor permeability, and resistant to heat deterioration up to 180 F for continuous periods or intermittent temperatures up to 250 F.

The compound can be used for outdoor applications without any effect on its properties except a slight surface hardening which may develop after long exposure. Uniseal may stain porous materials slightly but it is chemically neutral on lead, brass, copper, galvanized iron, lacquers or varnishes, etc. Rubber or rubber-insulated wire are not affected provided they are primed with varnish or shellac before application of the sealing compound.

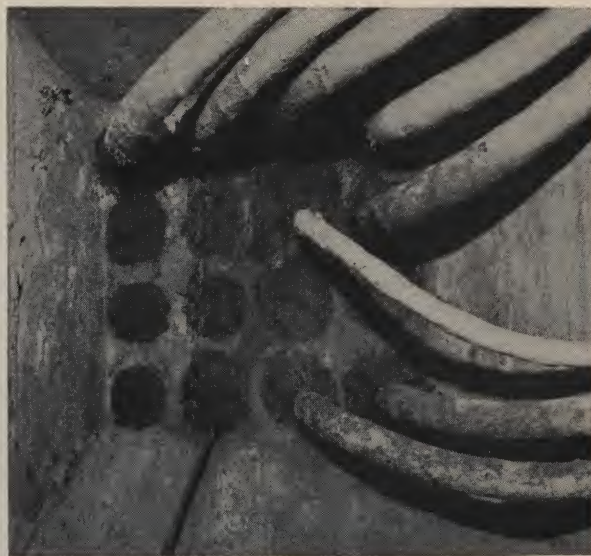
Uniseal is used effectively for sealing duct and box closures, smoothing mounting surfaces under street pedestals, closing open pipe ends, and for glazing and calking work in fume-laden rooms, roundhouses, etc.

The compound handles easily with a putty knife and retains for years its plasticity, adhesion, and resistance to water, heat and light. It can be painted over a priming coat of shellac, shellac substitute, or aluminum paint. Also, Uniseal is completely salvageable.

#### *Duxseal (For Electrical Work):*

Duxseal is a non-thermoplastic compound used for electrical application such as around rubber wire and cables in cellar and manhole entrances, potheads, etc. Since the compound is not thermoplastic, it permits expansion and contraction of cables without weakening its sealing properties. Duxseal will not slump under temperatures up to 125 F and remains workable and plastic at zero temperatures. It is insoluble in ground waters, unaffected by the gases or condensates usually encountered underground, and adheres readily to any type of duct wall which is reasonably dry and clean.

\* Reg. U. S. Pat. Off.



*All terminal openings of this power service to a large department store are sealed with Duxseal*

The compound is too stiff for gun application but can be easily applied by hand or calking tools with no injurious effects to the hands or upon metals and painted, varnished or lacquered surfaces. Because of sun and weathering effects, Duxseal is not so adaptable to outdoor applications as Uniseal. However, Duxseal may be painted with house paint without priming.

#### *Navaseal (For Marine Use):*

Navaseal is a black, odorless, asbestos-base sealing compound of stiff putty consistency developed for the sealing aboard ships of electrical duct services and other irregular apertures to prevent passage of moisture, fumes, vermin, or foreign matter.

The compound will remain plastic indefinitely under normal conditions of exposure to weather with only a slight surface effect. It will not run or slump and withstands intermittent exposure up to 190 F and continuous exposure to 130 F without harmful effects. It has excellent flame resistance and is highly water- and vapor-proof. Navaseal meets Military Specification MIL-I-3064 Grade H.

Navaseal can be readily applied by hand, knife, or calking tools and kneaded into long, thin rolls. It will not harm workmen's hands. Although the compound will adhere excellently to most surfaces, best results are obtained from surfaces that are clean and dry. Navaseal will soften and swell some types of rubber unless primed with a coat of varnish or shellac.



**Pakseal (For Severe Weather Conditions):**

Pakseal is a stiff type of sealing compound which can be applied only by calking tools. It is highly water-resistant and unaffected by continuous temperatures up to 140 F or intermittent exposures up to 200 F. It withstands weathering without effect except for a surface hardening. Metals or painted surfaces are not affected by Pakseal, but the compound is not suitable for use on rubber insulation.

It is common application practice to coat the area to be sealed with insulating-type varnish and force the Pakseal into place with mallet and calking iron. Such seals maintain strong adherence to surfaces, resilient stability of position and assure freedom from maintenance service and expense.

**Transeal (For Oil Exposure):**

Transeal is a sealing compound designed for use against refined oils, Transil and similar oils, as employed in transformers, oil switches, etc. It is highly water- and vapor-resistant, and unaffected by temperatures up to 145 F, except for a slight surface hardening.

The compound can be installed outdoors and hand-worked at any temperatures where workmen can function. It does not affect metals or painted surfaces and can be painted without a priming coat.

**Nodrseal (For Refrigerator Use):**

Nodrseal is an odorless sealing compound for use in domestic or commercial refrigerators. It is non-hardening and has excellent heat, weather, and light-resistant properties. It remains workable and plastic at sub-zero temperatures. Although Nodrseal may stain porous materials slightly, it has no effect on metals or painted surfaces, and it can be painted after the application of a priming coat of shellac, shellac substitute, or aluminum paint.

In practice, equipment manufacturers extrude Nodrseal by a "sausage-type" machine into strings of any desired cross-section. It is used for rapid application to the refrigerators at all openings where the entrance of vapor would result in the deterioration of the refrigerator frame or insulation. Nodrseal can be painted over a priming coat of shellac, shellac substitute, or aluminum paint.

**Weights and Packaging**

The sealing compounds weigh approximately 100 lb per cu ft and are supplied, except Nodrseal, in 1 and 5-lb pugs, in 60-lb standard cartons. Nodrseal is supplied in 75-lb cartons containing 6 unwrapped pugs.



*Terminal openings on left sealed with Duxseal. Group to right are still to be sealed*

**Table of Comparative Ratings**

The following table of comparative ratings of J-M Sealing Compounds (except Navaseal designed for marine use) is provided to assist in making a specific recommendation for a given service condition. Rating "1" indicates the best material, "2" the second best, etc.

Test	Uniseal	Duxseal	Pakseal	Transeal	Nodrseal
Weathering (200 cycles) Equivalent to 8 years outside exposure	1	4*	3	2	1
Water Absorption, 56 days at:					
115 F	1	4	2	3	1
140 F	1	4	2	3	1
180 F	3*	2	1	4*	3*
Vapor Permeability	1	4	2	3	1
Heat Hardening:					
140 F—6 months	1	3	3	2	1
180 F—6 months	1	3	4	2	1
250 F—1 month	1	2*	2*	2*	1
300 F—1 week	1	3	3	2	1
300 F—1 month	1	2*	2*	2*	1
350 F—1 week	1	2*	2*	2*	1
Adhesiveness on Steel	3	4	1	2	3
Effects on Various Materials:					
Copper	4	1	3	2	4
Brass	3	2	4	1	3
Leather	3	4	2	1	3
Rubber	4	2	3	1	4
Alkyd Enamel	1	1	1	1	1
Linseed House Paint	3	1	2	1	3
Nitrocellulose Lacquer	1	2	1	3	1
Clear Varnish	3	4	1	2	3
Alkyd Emulsion Paint	1	1	1	1	1
Oilproofness	4	3	2	1	4
Flammability	4	3	2	1	4
Insulation Resistance	3	4	2	1	3
Dielectric Strength	4	3	2	1	4

\* Indicates failure.



# Transite Conduit and Transite Korduct



*Transite Conduit and Transite Korduct with Harrington couplings*

The ultimate value of a conduit system for electrical conductors does not depend upon its initial cost alone, but rather upon its ability to serve and properly protect the cables and other electrical equipment for a long period of years.

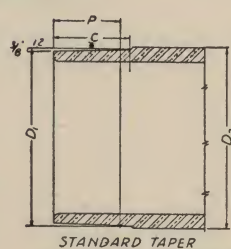
To assure most satisfactory and economical service, the conduit must be permanent. This, of course, implies that the material must be incombustible, mechanically strong, resistant to corrosive action and unaffected by electrolysis. An ideal conduit material should have a rapid rate of heat dissipation, and a low frictional coefficient. It should also be light in weight and easily installed.

J.M Transite Conduit, because of its asbestos-

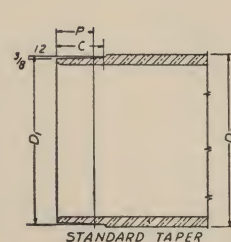
Transite Conduit			
Size (I. D.) Inches	Wall* Thickness, Inches	Standard Length, Ft.	Weight,* Lb. per Ft.
2	.35	5	2.3
3	.37	10	3.3
3½	.37	10	3.9
4	.37	10	4.4
5	.40	10	6.0
6	.40	10	7.0

Transite Korduct			
Size	Wall Thickness	Standard Length	Weight
2	.25	5	2.0
3	.27	10	2.5
3½	.27	10	3.0
4	.27	10	3.5
4½	.27	10	4.0
5	.30	10	5.0
6	.30	10	6.0

\* Tolerances for wall thickness and weights are as follows: Wall thickness,  $\pm 0.05$ "; weight,  $\pm 15$  percent. Weights shown include one Harrington coupling per length.



*Transite Conduit Tapered for Harrington Coupling*



*Transite Korduct Tapered for Harrington Coupling*

Size	D <sub>1</sub>	D <sub>2</sub>	C	P
2	2.58	2.70	1.75	1.50
3	3.62	3.74	1.75	1.50
3½	4.12	4.24	1.75	1.50
4	4.62	4.74	2.00	1.75
5	5.68	5.80	2.00	1.75
6	6.68	6.80	2.00	1.75

Size indicates nominal I.D. of conduit in inches.

Size	D <sub>1</sub>	D <sub>2</sub>	C	P
2	2.36	2.50	1.00	0.75
3	3.39	3.54	1.13	0.88
3½	3.89	4.04	1.13	0.88
4	4.39	4.54	1.25	1.00
4½	4.89	5.04	1.25	1.00
5	5.45	5.60	1.38	1.13
6	6.46	6.60	1.50	1.25

Size indicates nominal I.D. of conduit in inches.



cement composition and the method of manufacture, has fulfilled these requirements to the satisfaction of users from the time when it was first offered to industry. But most important, the strength and durability of this material are such that it is used in underground systems without the usual concrete envelope.

J-M Transite Korduct,\* a lighter-weight material, is

identical with Transite Conduit except in wall thickness. It is designed for use where the duct is to be incorporated in concrete or masonry structures or where conditions necessitate the use of a concrete envelope. Because of its light weight and rapid installation features, Transite Korduct offers important installation economies.

\* Reg. U. S. Pat. Off.



*Transite Conduit and Transite Korduct are manufactured at the Johns-Manville plants in Waukegan, Illinois, Manville, New Jersey and Watson, California*



## Advantages of Transite Conduit

Because of its composition and method of manufacture, Transite Conduit possesses many advantages which make for long life and efficient service in both underground and exposed ducts. When encased in concrete underground or buried in earth, the Conduit carries the Underwriters' Laboratories approval.

**Strength:** When asbestos fiber and cement are combined under heavy pressure, a surprisingly strong material is produced. Compared with ordinary first quality concrete, such a mixture has approximately five times the tensile strength and three times the compressive strength.

The crushing strength of Transite Conduit is considerably greater than is ordinarily required for culvert work. When installed under streets and highways without a concrete envelope, it has sufficient strength to resist any load that will normally be put upon it. Its strength as a beam is such that, when properly installed in firm ground, it will withstand all normal stresses. Also, up to the ultimate strength of the Conduit, there is no deformation under sustained loads over an indefinite period of time.

As an exposed conduit, this material has been widely used both for outdoor ducts runs and lines within buildings. It is entirely satisfactory for all types of such service except in locations where it would be required to withstand the impact of heavy vehicles.

**Corrosion Resistance:** Transite Conduit is practically unaffected by corrosion. It resists the action of corrosive cinder fills, salt marshes and other naturally troublesome soils. It withstands the attack of smoke fumes and corrosive atmospheres.

Transite is also highly resistant to the corrosive action of many chemicals, and weather conditions have little, if any, effect upon it. Stocks of the material are often stored outdoors, both summer and winter, for long periods without injury.

**Inertness:** Extensive research has developed a curing process which assures a rapid completion of the chemical reactions which the cement in Transite undergoes. As a result of this process, the amount of free alkali in the finished product is far below that found in the usual portland cement products. The alkalinity of Transite Conduit is actually lower than that of many common soils.

**Immunity to Electrolysis:** The use of non-conductive materials in the manufacture of Transite makes it immune to electrolysis.



*A 9-way Transite Conduit duct line for power and signal cables, installed without a concrete envelope by the Chicago Surface Lines, Chicago, Ill.*

**Non-Inductive:** Because of its nature, Transite is also non-inductive. This is an especially important factor in conduit carrying single-phase alternating current lines.

**Incombustibility:** The ingredients which enter into the make-up of Transite are positively incombustible. The Conduit will not contribute to the generation of fumes or combustible gases when burnouts occur. Furthermore, the resistance of Transite Conduit to heat, flames and arc is very high.

**Low Coefficient of Friction:** The close-grained structure of Transite provides a smooth interior surface. The resultant low coefficient of friction permits long pulls of cable through the duct with ease. No dangerous abrasive particles that might damage the cable sheath are present on the interior surface.

The cable will not adhere to the duct, regardless of the temperatures encountered, whether operating temperatures or excessive temperatures due to fault, up to the point where an arc is intense enough to fuse the surrounding mass. Under the action of an arc, the duct spalls away in small flaky particles which can readily be removed by a swab so as not to cause damage to the cable sheath.

### ADVANTAGES OF TRANSITE CONDUIT

May, 1947 (Cancelling sheet dated September, 1939)

EL-201



**Installation Advantages:** Mechanical strength and comparatively light weight make possible the manufacture of Transite Conduit in long, easily-handled lengths. This advantage makes for rapid installation and a minimum number of joints.

Tight joints are assured in Transite Conduit by the use of Harrington couplings which are machined to fit snugly over the tapered ends of the conduit sections and fittings. This type of joint, moreover, makes for rapid assembly and permits the joining of multiple units either on the job or in the shop. The conventional method of assembly is to apply the coupling by placing a slat against it and tapping lightly on the slat with a hammer. Inasmuch as the wedging action of the tapered joint can exert a tremendous force on the coupling, care should be exercised to avoid driving it home to forcefully.



*Transite Conduit erected indoors in the building of a large public utility company*

## Uses of Transite Conduit

Transite Conduit lends itself to wide range of service in the electrical field. It is equally suited to installation underground and overhead. For exposed ducts it can be used both within the building and outdoors. For underground service it does not require a protective concrete envelope.

**Underground Conduit:** The elimination of the concrete envelope through the use of Transite Conduit affords important installation economies, especially in the case of smaller duct lines. Estimates of savings vary from 10 to 15 percent on lines up to 6 ducts per trench. The experience of users since 1930 indicates that in every case actual savings are equivalent to, if not greater than, the estimates. The great range of variation is readily understood when consideration

is given to the exceedingly variable nature of such items as the type of paving involved, type of soil, cost of excavation and number of ducts per trench.

Installation of Transite Conduit in firm soils involves only ordinary care. Trench bottoms should be accurately graded and leveled and proper attention given to the selection and placing of the backfill.

Among the types of circuits in service in Transite Conduit without a concrete envelope are:

### **Power Circuits**

- services
- secondary distribution
- mains
- primary feeders
- series and multiple street
- lighting circuits
- transmission cables
- control circuits
- generator leads

### **Communication Circuits**

- telephone services
- telephone exchange cables
- telephone tool cables
- telephone cables

### **Signal Circuits**

- fire alarm
- police signal
- traffic signal
- railway signal



*Transite Conduit mounted on exterior wall of a substation*

**Outdoor Exposed Conduit Systems:** In exposed locations, particularly where corrosive atmospheric conditions exist, Transite Conduit has proved to be an excellent material because of its resistance to the deteriorating effects of weather and gases. One of the best examples of this type of installation is on bridges over railroad tracks. The conduit may be attached to any rigid structure such as a bridge, building, crane runway or retaining wall.

Where the duct line will be subjected to severe mechanical abuse, especially shock, Transite Conduit should not be used. It is unsuited to locations where it would be required to withstand the impact of trucks and other heavy vehicles.



Expansion and contraction of the duct should be provided for in installation by means of proper supports and expansion couplings.

**Indoor Exposed Conduit Systems:** Transite Conduit combines the functions of a conduit and cable fireproofing. The non-inductive nature of the duct, combined with its incombustibility, makes it a logical material for the protection of lines within the building. This is particularly true where single-phase alternating current circuits are encountered.

Because the material resists corrosion, it may be used in locations where moisture and most corrosive fumes are present in the atmosphere.

Where National Electric Code rules apply, specific approval must be obtained for exposed conduit runs.

This is due to the non-conductive properties of Transite. In general, good grounding of all metal fittings, etc., is the maximum requirements of Inspection Boards. Buried or concrete-encased installations require no special approval.

**Combination Systems:** For industrial buildings, Transite Conduit may be used both underground and exposed to carry power lines to point of load application. The conduit may be laid in trenches leading from the main source of electrical power to any particular building or load location. Then underneath or through the concrete sub-floor to the side wall where the conduit will run exposed through the building as required. Also, the conduit may be run exposed to the building and over roof to enter through sidewall.

## Advantages of Transite Korduct

Varying from Transite Conduit only in wall thickness, Transite Korduct possesses all of the inherent characteristics of that material. Of the same composition and method of manufacture, Korduct is equally as corrosion-resisting, incombustible and inert. It also is non-inductive and immune to electrolysis.

**Strength:** Korduct is just as strong per unit of wall thickness as Transite Conduit, but because of its thinner wall, it is recommended for use only where a concrete envelope is necessary or under conditions where mechanical strength is not a prime requirement.

**Incombustibility:** The mineral nature of the materials used in Korduct assures positive immunity to burning under the heat of a short circuit. In addition to minimizing the effects of the burnout, it will not contribute to fumes or combustible gases that may be generated. Thus the danger of manhole explosions and duct fires are materially reduced.

**Non-Adhesion of Cables:** Under actual field conditions, cables will not adhere to Korduct. Even under the action of a severe arc, up to the point of destruction of the concrete surrounding the duct, Korduct assures easy removal and replacement of damaged cables. There will be no adhesion between the cable and the duct, nor will the original low coefficient of friction of the material be appreciably increased. The Korduct will slowly spall away in small flaky particles which may be easily removed, but in no event will they cause any serious scoring of the cable sheath.

**Rapid Heat Dissipation:** Transite Korduct offers an important advantage over ducts which are less efficient heat conductors. For the service encountered in

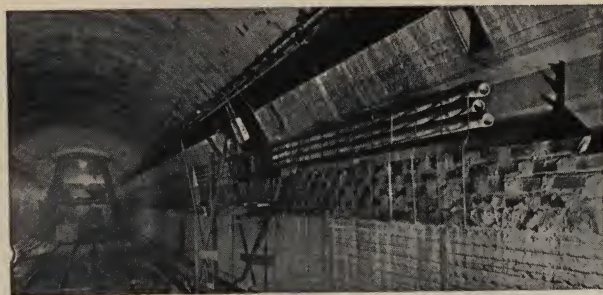
underground duct lines, Korduct has a thermal conductivity of approximately 3\* Btu per sq ft per F temperature difference between surfaces per hour, for a thickness of 1". The limit to the amount of energy that can be forced through a cable is largely determined by the rate of heat dissipation. Even very small reductions in the temperature of the conductors is commonly recognized as of great value in respect to system capacity per dollar of investment. Also,



*Transite Korduct in a typical underground duct line before encasing in concrete*

\*This is minimum. The average for Transite materials under various conditions of service is 4.5.





*Transite Korduct in Mid-Town Hudson Tunnel, N. Y. C.*

there are direct benefits from lower line loss, increased life of cable insulation, lower dielectric loss and improved power factor. These qualities in a

duct material are of more value today than ever before owing to the necessity of operating systems at maximum safe capacity.

**Greater Effective Thickness:** Since the composition of Korduct is similar to the enclosing concrete envelope, the walls of the Korduct may be considered part of the thickness of the separating concrete required between adjoining banks of ducts. Therefore, in order to obtain the same fire protection between cables and heat dissipation qualities, it is necessary with combustible or organic ducts to increase the amount of concrete separation. This means increased cost of excavation, repaving and additional concrete.

## Uses of Transite Korduct

Transite Korduct was developed expressly to provide, in the most economical manner possible, all the permanent qualities of a Transite duct for locations where the conduits must be incorporated in concrete or masonry structures, and in those underground installations, where the application of a concrete envelope is considered to be essential.

The Korduct is sufficiently strong to assure safe shipment and handling as well as to perform satisfactorily under all ordinary concreting operations.

**Encased in Concrete Structures:** Wherever a duct is installed in a concrete or masonry structure, Transite Korduct offers decided advantages. Under the heaviest and most unfavorable conditions, particularly where mechanical vibrators move within the concrete mass at the time of pouring, it may be advisable to consider the use of Transite Conduit or some other duct of greater mechanical strength. However, Transite Korduct has been installed in foundations, in tunnel walls and bridges where heavy batches of concrete were poured.

The speed with which the long sections can be installed eliminates loss of time and expense in completing the structure. Fewer joints are required than with any other non-metallic conduit on the market.

**Underground with a Concrete Envelope:** In constructing the typical underground duct line any of the conventional methods may be used, either tier by tier or monolithic. Assembled with Harrington couplings, the duct is quickly installed with tight joints. The long lengths in which it is furnished make rapid installation possible and reduces materially the number of spacers or supports required. Utilizing the thickness of the Korduct as additional fireproof separation between cables, a superior duct line is obtained

per unit of cost. These, in addition to the service advantages, afford in Transite Korduct a remarkably economical duct line.

Because of its smooth interior surface, long lengths of cable can be pulled through the duct without injury to the sheath and cables can be removed more readily than from any other commonly used duct. In addition, the inherent qualities of Transite insure long service at low cost.



*Tiers of Transite Korduct in underground construction partially enclosed in concrete*



## Fittings, Special Conduits and Accessories

A complete range of fittings and couplings permit the adaption of Transite Conduit and Transite Korduct to a wide variety of installation conditions.

The Harrington coupling, used to join succeeding sections of both types of duct, is machined in the interior to fit the standard taper to which the duct ends are machined. In addition to making a silt-tight joint, the Harrington coupling assures rapid assembly and correct alignment of the duct. It also permits slight changes in direction, providing flexibility for laying the conduit to a large radius curve.

Duplex and double duplex adapters are used to assemble a tapered end with an untapered end and two untapered ends, respectively, of Conduit or Korduct.

Other types of adapters are furnished for joining Conduit or Korduct to practically any other type of duct. They are also used for making transitions from one size to another as required.

Expansion couplings and flexible connections permit the use of the duct where expansion and contraction or severe vibration create service problems. A center make-up connector facilitates the assembly of the line by permitting the joining of duct runs which are laid from opposite directions.

Curved segments, deflection couplings, sweeps, bends, elbows, laterals, tees and other fittings provide maximum flexibility in laying out a duct system.

The variety of standard fittings available, with drawings giving dimensions, etc., are described on other data sheets. This information, as well as complete details covering general description, advantages and installation, is included in DS Series 410, "Transite Conduit and Transite Korduct for the Electrical Industry."

### Special Conduits

Transite Conduit and Transite Korduct can be readily cut and machined for various purposes. Such conduit, as set forth in the following paragraphs, can be supplied on special order.

**Split Conduit:** Both types of duct can be split lengthwise into two or more sections as required. Allowance must be made for the material lost by the saw kerf. It is recommended that the length of split conduit be confined to 5 ft.

**Slotted Conduit:** Transite Conduit and Korduct can be slotted to provide a tree wire guard, although it is recommended that Transite Conduit be used for such service because of its greater strength.

**Short Lengths:** Both materials can be furnished in any length that may be cut from 10-ft sections. Allowance must be made for saw kerf and waste.

**Increased Wall Thickness:** Where a duct of greater wall thickness is desired, it is possible to build up the Transite Conduit wall, within reasonable limits, to the following maximum thicknesses: 2" Conduit, approximately  $\frac{3}{4}$ "; 6" Conduit, approximately  $1\frac{1}{2}$ "; the other sizes in proportion. Increased wall thickness imparts additional beam and crushing strength, but the resulting strengths are not increased in proportion to wall thicknesses.

**Special Sizes:** Transite Conduit can be furnished in sizes larger than 6" inside diameter. The larger sizes, maximum 36" inside diameter, are furnished in standard lengths of 13 ft with half sections and cut lengths also available.

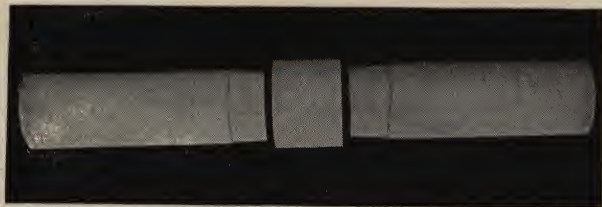
### Accessories

**Transite Conduit Tapering Tool:** A tool designed for quick and accurate tapering of Conduit and Korduct in the field. A strong box, built to withstand severe service, contains the complete equipment for all sizes of conduit up to 6" inclusive. The complete kit weighs about 16 lb, measures approximately  $4\frac{1}{2}$ " x  $8\frac{1}{2}$ " x 28" and can be easily carried by hand. A detailed description of the tool appears on instruction sheets which are included with every tool.

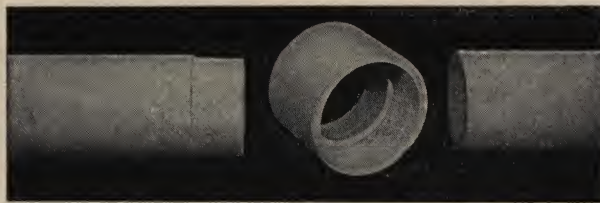
**Joint Sealing Compound:** When it is required that the joints of a duct line be waterproof, a special joint sealing compound is used. Composed of asphalt with asbestos fiber and other inert fillers, it sets slowly and yet adheres quickly and firmly to Transite and other similar materials. When it has set, a very solid waterproof bond is formed which resists all soil and atmospheric conditions.

Joint Sealing Compound is furnished in containers weighing approximately 3, 10, 50, 150 and 300 lb. One pound of the compound will seal a number of joints equivalent to 50 divided by diameter of the conduit in inches. For example, 1 lb of the joint compound will seal 25 joints of 2" conduit.

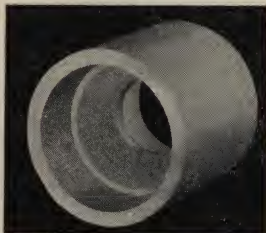




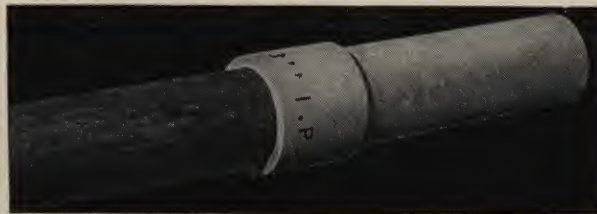
*Harrington Coupling*



*Duplex Adapter*



*Reducing Adapter*



*Adapter joining metal and Transite Conduit*



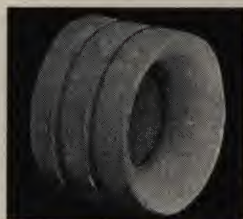
*Flexible Connection*



*Center, Make-Up Connector*



*Pole  
Riser  
Cap*



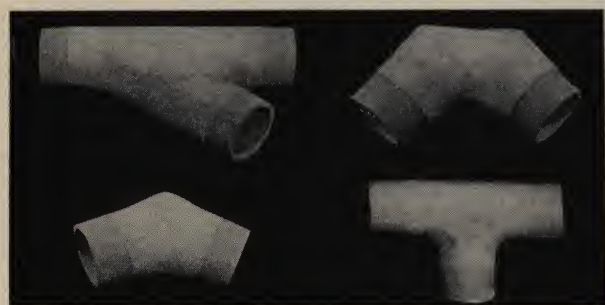
*End Bell*



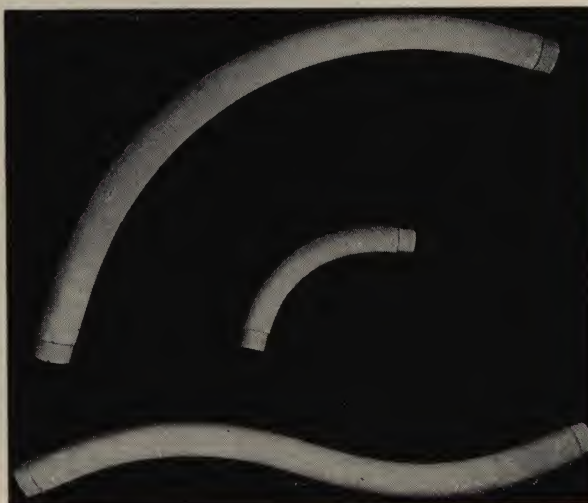
*Expansion Coupling*



*Cap*



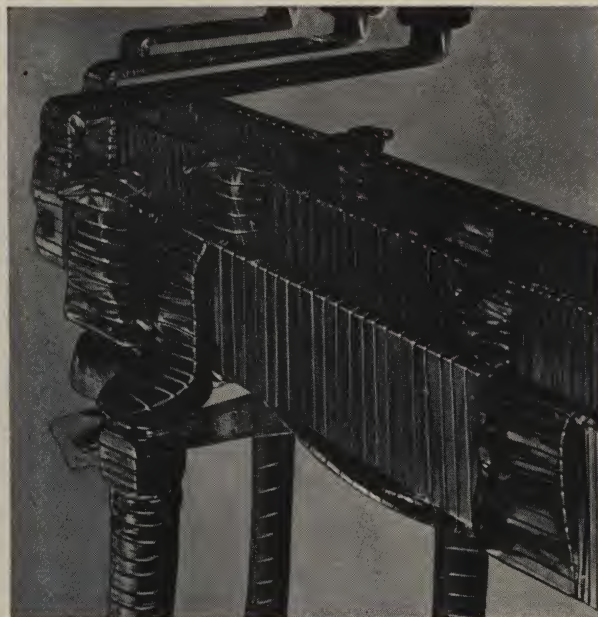
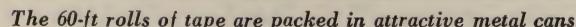
*Tees, Elbows and Laterals*



*Bends*



Several types of plastic find general commercial use as a backing material, with vinyl by far the most important. High dielectric strength and thin caliper, combined with durable physical characteristics make vinyl backed tapes an ideal primary insulator. High



chemical and abrasion resistance make vinyl tapes handy for such miscellaneous uses as protective wrapping on tool handles. The sleek-surfaced tape will not

## Electrical (0.007" and 0.010" thicknesses)

Dielectric Strength (Average), volts per mil.....	1000
Power Factor, at 60 cycles.....	0.07
at $10^6$ cycles.....	0.03
Dielectric Constant, at 60 cycles.....	3.40
at $10^6$ cycles.....	2.60

	<u>0.007" thickness</u>	<u>0.010" thickness</u>
Thickness Film .....	0.006"	0.009"
Thickness Adhesive .....	0.001"	0.001"
Thickness, Total .....	0.007"	0.010"
Tensile Strength, Lb per in. width, min.....	20	30
Stretch, Percent .....	150-200	150-200
Adhesion, Highly Polished Surface, Oz per in. width..	25	25

Resistance to Acids, Alkalies	
Corrosion, Salts and Water.....	Excellent
Resistance to Oils, Grease,	
Alcohols and Anti-Freeze Solutions.....	Good
Resistance to Aging (Room Temperatures).....	Excellent



pick up dirt, dust, or oil and will retain an attractive appearance despite abuse in service. In addition, vinyl tapes afford good protection against weather.

Capitalizing on the inherent elasticity of vinyl plastic, Jomanco Tape can be stretched from 150 to 200 percent of its own length before breaking. By A.S.T.M. test method, average dielectric strength is approximately 1000 volts per mil of thickness. Minimum tensile strength in 7 mil thickness is 20 lb per inch of width and in 10 mil thickness, 30 lb per inch of width.

Jomanco Plastic Electrical Tape is supplied in standard 0.007-inch gage and heavy duty 0.010-inch gage.

The extra heavy duty 0.010-inch tape is particularly adapted for use with power-driven taping machines, making splices in heavy cable and binding heavy electrical harness.

Standard 0.007-inch tape is available  $\frac{3}{4}$  inches wide in lengths of 20 feet, 30 feet and 60 feet.

The 0.007 inch and heavy duty 0.010 inch tapes are available in 36-yard jumbo rolls in widths of  $\frac{3}{8}$ " (0.007 inch only),  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1" and 2".

For further details of both the 0.007-inch and the 0.010-inch tapes, see the table following.

**Packaging Data**

Thickness, Inches	Width, Inches	Roll Length, Ft	Rolls per Std. Case	Individual Container	Method of Packaging
0.007	$\frac{3}{4}$	20	100	None	Rolls individually wrapped and labeled and packed in Handy Shop Packages (cylindrical containers), 10 rolls per package and 10 packages per case
0.007	$\frac{3}{4}$	30	144	Paper Carton	Rolls individually packed in paper cartons, 12 rolls to a display carton
0.007	$\frac{3}{4}$	60	48	Round Metal Can	Rolls individually packed in metal cans, 12 rolls per carton
0.007	$\frac{3}{8}$	108	100	None	Rolls individually wrapped and labeled and bulk-packed in cases
	$\frac{1}{2}$	108	72	None	
	$\frac{3}{4}$	108	48	None	
	1*	108	36	None	
	2	108	18	None	
0.010	$\frac{1}{2}$	108	72	None	Rolls individually wrapped and labeled and bulk-packed in cases
	$\frac{3}{4}$	108	48	None	
	1*	108	36	None	
	2	108	18	None	

\* Also available in special widths between 1" and 2".



## J-M Friction and Rubber Tapes

J-M Friction and Rubber Tapes, during their many years of service to industry, have earned a reputation for quality and dependability. The friction tapes are woven from carefully selected sheetings, impregnated with an insulating compound, and coated with a high-grade adhesive rubber composition. J-M rubber tapes are self-welding without the application of heat, and are easily applied.

**Friction Tapes:** These tapes are furnished in three types under the names of "Hi-Value," "4 Star," and "J-M Friction."

**Rubber Tapes:** The rubber tapes, for easy splice making, are known as "Hi-Value" and "Brooklyn."

### Friction Tapes

**Hi-Value Friction Tape:** A non-raveling black friction tape which is constructed of four layers of the finest rubber insulating compound, thoroughly impregnated into carefully selected fabric sheeting. It possesses superior aging, insulating and electrical properties. Hi-Value meets A.S.T.M. Specifications.

**4 Star Friction Tape:** An economical black tape with good aging, insulating and electrical characteristics. It is constructed of four plies of a good rubber insulating compound, two plies on each side of a strong cotton sheeting fabric.

**J-M Friction Tape:** A four-ply, general-purpose black tape made from cotton sheeting with high tensile strength. The thorough impregnation of insulating compound and coating of carefully formulated adhesive rubber composition gives this tape its high dielectric strength, strong adhesive properties and excellent aging characteristics.

### Rubber Tapes

**Hi-Value Rubber Tape:** A self-welding, rubber insulating tape of the highest quality. In application, the rubber tape is served over the joint in lapped spirals to the desired thickness. The tape vulcanizes into one solid tube under average atmospheric conditions. Hi-Value contains natural rubber, free from sulfur and corrosive chemicals, resulting in maximum stretching without breaking. It meets A.S.T.M. Specifications.

**Brooklyn Rubber Tape:** A general-purpose tape which is especially sticky for easy splice-making. It strips cleanly from the separator, leaving both surfaces



*All J-M Friction Tapes are constructed with four layers of insulating rubber compound thoroughly impregnated into fabric sheeting of the finest quality*

tacky and makes a good splice which fuses into a solid bond. The tape has good aging and tack-retaining characteristics. Contains no sulfur or corrosive chemicals.

### Method of Ordering

**Standard Cases:** The standard case of No. 8 roll size is 108 rolls; No. 4 size, 216 rolls; No. 2 size, 432 rolls. Orders should be confined to such multiples.

**Protective Wrapping Only:** All tapes are obtainable in protective wrapping only, without cartons, at a reduction in price.

**Handy Shop Package:** An economical way for repairmen, contractors and industrial users to buy tape since the cost of individual cartons is eliminated. Tape in this cylindrical package is readily accessible and the unused rolls are protected from dirt and grease. Contains 10 rolls of No. 8 size J-M Friction Tape.

**Display Carton:** An attractive counter package containing 12 rolls of No. 4, 16 rolls of No. 2, and 32 rolls of No. 1 size J-M Friction Tape.

**Special Widths:** All items may be ordered in special widths,  $\frac{1}{2}$ " being the minimum. The price is exactly proportional to the relation which the width ordered bears to the standard  $\frac{3}{4}$ " width. Such special widths are supplied in protective wrapping only with a deduction allowed for carton omission.



*Data on J-M Friction Tapes and Rubber Tapes***FRICTION TAPES, ALL  $\frac{3}{4}$ -INCH WIDE\***

Name	Roll Size	Length per roll, feet	Rolls per standard case	Type Container	Method of packaging
<b>**HI-VALUE</b>	No. 8	82½	100	Individual Carton	Rolls are protectively wrapped and individually packed in paper cartons
	No. 4	41½	200		
<b>4 STAR</b>	No. 8	68	108		
	No. 4	32	216		
<b>J-M</b>	No. 8	60	108	Display Carton	Rolls are protectively wrapped, individually packed in paper cartons and furnished in a display carton containing 12 No. 4, 16 No. 2 and 32 No. 1 rolls
	No. 4	30	216		
	No. 2	13	432		
	No. 1	5	864	Handy Shop Package	10 rolls, with wax paper separation between rolls, packed in a tamper-proof cylindrical package
	No. 8	60	100		
	No. 4	30	216		

**RUBBER TAPES, ALL  $\frac{3}{4}$ -INCH WIDE\***

<b>**HI-VALUE</b>	No. 8 No. 4	30 15	100 200	Individual Carton	Rolls are protectively wrapped and individually packed in paper cartons. A Holland cloth separator is wound on the rolls with the tape to prevent the layers of rubber from coming in contact until ready for use
<b>BROOKLYN</b>	No. 8 No. 4	22 10	108 216		

\* Also available in special widths of  $\frac{1}{2}$ " thru 2". Protective Paper wrapped only.

\*\* Meets American Society for Testing Materials (A.S.T.M.) Specifications.



*The illustration above shows friction tape being cut into standard roll widths*



## J-M Asbestos Papers and Tapes

J-M Asbestos Papers and Tapes are thin, fireproof asbestos products, made from specially selected fibre. They offer protection and insulation to such units as electrical heaters and thermal operating devices. They provide coil insulation for mill and railway type motors, and for solenoids, or other coils which are used under heat.

Wherever high temperatures are encountered, paper manufactured from asbestos is the most serviceable and economical material since it is unaffected by temperatures up to 400 deg. F., contrasted with the loss of strength and other desirable properties of rag or pulp papers at temperatures below 200 deg. F. Even a relatively thin covering applied over the outside of organic coil insulations will greatly increase the life of the coil. Coils so protected from the action of air can be run at higher temperatures than the safe operating point of organic insulations not so protected.

Asbestos fibre is entirely inorganic and, to produce it in paper form, it is necessary to add a binder. The amount of binder is held to a minimum as the principal property desired of an asbestos paper is high heat resistance. Consequently the tensile strength is not at higher temperatures than the safe operating point papers, but it is amply strong for a majority of applications. Armature Reinforced Asbestos Paper is reinforced by a strong, cotton-scrim cloth inserted between

the asbestos paper faces. Although the cotton reinforcement may be weakened by exposure to temperatures above 212 deg. F., the asbestos paper facings remain unharmed to 500 deg. F.

All the papers listed in the following table, with the exception of the non-ferrous type, are made from selected Canadian chrysotile asbestos fibre. The non-ferrous paper is made from selected long Arizona chrysotile. The primary difference between these types of fibre is that the Arizona fibre is practically iron-free, whereas the Canadian contains a small percentage of free magnetic iron, usually not exceeding 5 percent. The grain size of this free magnetic iron ( $\text{Fe}_3\text{O}_4$ ) averages only 0.002" in diameter and, as the particles occur singly, the paper is not rendered unsuitable for a dielectric under moderate voltage.

No general rules can be given for the choice between Canadian or Arizona paper. Around metering or electrical recording devices, Arizona paper should be selected. The same rule applies where tape less in total thickness than about 0.015" is used on conductors or coils. The majority of manufacturers, particularly those manufacturing appliances and apparatus, have standardized on asbestos paper made of Canadian fibre and it is recommended that prospective users determine experimentally whether such tape will not serve in view of its greater economy.

*Description and Qualities of J-M Asbestos Paper (Tapes, 1" wide)*

Name	Thickness inches			Approx. lb. per 100 sq. ft.	Approx. lin. ft. std. roll 7" dia.	Approx. ft. 1" wide per lb.	Minimum width† to which can be cut	Minimum asbestos content, percent	Maximum carbon content, percent	Maximum free-iron content, percent	Average tensile strength, lb., 1" W.		Strength, Mullen test, lb.	Recommended temperature limit, deg. F.	Dielectric test values*
	Nominal	Minimum	Maximum								Machine direction	Cross machine direction			
<b>Fibroid</b>	.012	.010	.014	4.2	260	300	3/8"	90	5	6.0	8	3	4 to 8	500	82
	.016	.014	.018	6.0	195	200	"	91	5	6.0	10	3	8 to 12	500	
	.018	.016	.020	8.0	175	150	"	93	4	6.0	12	4	8 to 16	500	
	.022	.020	.024	10.0	145	120	"	95	3	6.0	14	4	8 to 16	500	
	.026	.024	.028	12.0	120	100	"	95	3	6.0	16	4	8 to 16	500	
	.029	.027	.032	14.0	110	86	"	96	2	6.0	18	4	10 to 16	500	
	.032	.030	.035	16.0	100	75	"	96	2	6.0	20	5	10 to 18	500	
	.062	.060	.067	32.0	50	37	1/2"	96	2	6.0	22	6	20 to 30	500	
<b>High Strength Fibroid</b>	.007	.005	.009	2.1	450	570	3/8"	90	5	5.0	10	4	5 to 10	600	105
	.008	.006	.010	2.6	395	460	"	90	5	5.0	12	4	7 to 15	600	
	.010	.008	.012	4.2	315	285	"	90	5	5.0	14	4	8 to 16	600	
<b>Armature Reinforced</b>	.015	.014	.018	6.0	210	200	3/8"	84	8	5.0	20	6	22 to 28	500	92
<b>Non-ferrous</b>	.007	.005	.009	2.6	450	460	3/8"	75	10	0.5	9		5 to 8	400	102
	.010	.008	.012	3.7	315	335	"	77	8	0.5	14		7 to 11	400	
	.015	.013	.018	5.7	210	210	"	80	8	0.5	18		10 to 14	400	

\*The dielectric test is the average of ten dielectric punctures with A.S.T.M. 2" disc electrodes. Voltage increased to puncture in about ten seconds. The figures show volts per mil to puncture paper after 48 hours at 75 percent relative humidity. †Width tolerance is  $\pm 1/4$ ".

### ASBESTOS PAPERS AND TAPES

December, 1946 (Cancelling sheet dated September, 1945)

EL-350



# J-M Asbestos Listings and Braided Tubing

## Asbestos Listings

J-M Asbestos Listings are fireproof, flexible, woven tapes made from Canadian chrysotile asbestos, suitable for wrapping all forms of wires, cables and coils and for motor and transformer windings. The listings are also used in hot processes for winding on tool handles and as "pulls" for trays in heat-treating ovens.

J-M Listings are all closely woven and have a smooth surface with the exception of thicknesses 0.025" and lower which have a more open weave than the other styles as a more exact thickness must be maintained. Style No. 1096 is more closely woven and much stronger than No. 1091.

### Types and standard sizes\*

Width, inches	Underwriter's			Commercial			
	No. 1055 plain, 0.020" thick	No. 1064 plain, 0.025" thick	No. 1065 plain, 1/32" thick	No. 1073 plain, 1/32" thick	No. 1091 wire-inserted, 1/16" thick	No. 1091 plain, 1/16" thick	No. 1096 plain, 1/16" thick
Approximate feet per lb.							
1/2	240	166	122	122	64	84	76
3/4	178	110	82	82	45	56	50
7/8	161	95	73	73	36	48	43
1	133	80	65	65	32	42	39
1 1/4	106	66	54	54	27	34	30
1 3/8	94	61	48	48	25	31	28
1 1/2	83	55	43	43	22	28	25
2	—	41	33	33	17	21	19
2 1/2	—	—	—	—	13	17	15
3	—	—	—	—	11	14	13
Approximate feet per roll							
1/2	100	100	100	100	100	100	100
3/4	100	100	100	100	100	100	100
7/8	100	100	100	100	100	100	100
1 to 3	150	150	150	150	150	150	150

\*Greater thicknesses and widths can be supplied on application.

Asbestos Listings numbered 1055, 1064 and 1065 are furnished in Underwriter's grade (maximum allowed carbon content of 10 percent) as a standard. No. 1073, No. 1091 and No. 1096 are furnished as standard in Commercial grade (about 80 percent asbestos). Listings up to 100 percent asbestos content, and listings made from Arizona non-ferrous asbestos, can be furnished on special order.

## Oil Burner Listing or Wick

J-M Oil Burner Listings or Wicks, specially designed for use in oil burning apparatus, are made of Canadian chrysotile asbestos fibre woven and reinforced with 0.008" diameter brass wire.

The listings are also furnished with two additional, parallel, heavy brass wires which stiffen the listing so

that the proper shape is retained when installed circularly on edge in oil burning elements.

Style No. 1092, made of commercial grade fibre containing up to 80 percent asbestos, is most commonly used. Style No. 592 is made of AA grade, guaranteed to contain not less than 90 percent asbestos.

### Types and sizes\*

Width, inches	Plain wire reinforced		With two additional wires	
	No. 1092 com. 1/16" thick	No. 592 AA quality, 1/16" thick	No. 1092 commercial, 1/16" thick	No. 592 AA quality, 1/16" thick
7/8	39	Approximate feet per lb.		25
1 3/8	25	39	25	20
		Approximate feet per roll		150
7/8, 1 3/8	150	150	150	150

\*Greater thicknesses and widths can be supplied on application.

## Braided Asbestos Tubing

J-M Braided Asbestos Tubing is made of commercially pure asbestos yarn (approximately 80 percent asbestos), braided into flexible tubing of various sizes. Its principal use is as a covering for wires to protect them against heat or chemicals.

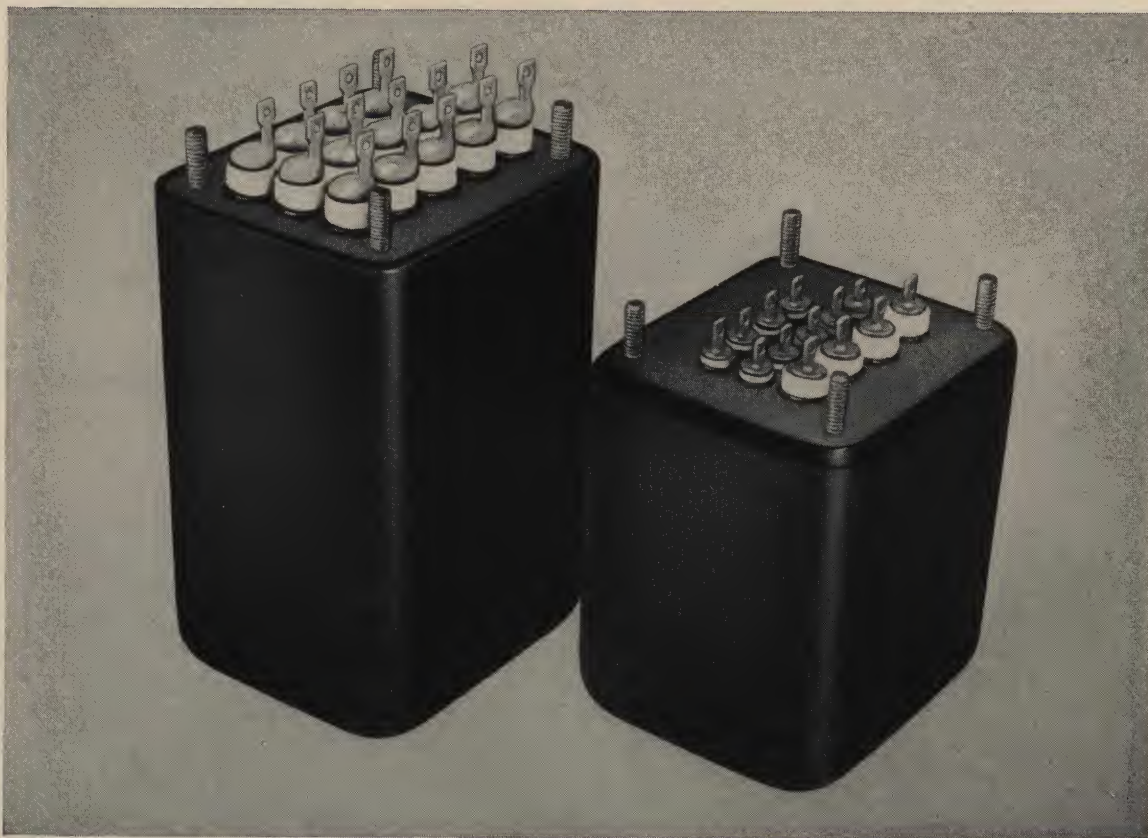
Braided tubings are flexible and the diameters given are for tubings expanded to normal size. In tubings numbered 1529, 1530, 1531 and 1532, the width given can be varied as much as 1/4" wider or narrower by stretching the tubing out or pushing it in, due to its extreme flexibility in these sizes. Styles No. 1519 to 1522 inclusive are finished with a coating of size. All other styles have a plain finish.

### Sizes and weights of Braided Asbestos Tubing

Style No.	Inside diameter, inches	For use over wire No.	Outside diameter, inches	Approximate flat width, inches	Approximate ft. per lb.
1516	1/64	17 B and S	1/8	Furnished Round	175
1517	1/32	10 B and S	5/32	Furnished Round	100
1518	1/16	8 B and S	3/16	Furnished Round	85
1519	1/8	5 B and S	1/4	5/16	65
1520	3/16	4 B and S	5/16	3/8	50
1521	1/4	2 B and S	3/8	1/2	45
1522	5/8	0 B and S	1/2	5/8	23
1523	1/2		5/8	3/4	20
1524	9/16		11/16	7/8	16
1528	5/8		3/4	1	15
1529	3/4		7/8	1 1/8	14
1530	1 1/8		1	1 1/4	12
1531	1 1/2		1 1/4	1 1/2	10
1532	1 3/4		1 1/2	1 3/4	9



## Quinterra Electrical Insulations



*Both transformers carry the same rated output. The one on the right has Quinterra layer insulation between coil windings, while the one on the left has conventional insulation. Savings in space, materials and weight through the use of Quinterra permit economical design of new apparatus or the re-design of existing equipment*

Most authorities agree that pyrolysis—the gradual breakdown of insulation by heat—is both a major cause of electrical equipment failures and a severe limiting factor in design. A number have stated that if a sheet insulation with high resistance to pyrolysis were developed, it would do more than contribute to safety and longer equipment life. It would permit equipment to be designed for higher temperature operation with consequent savings in space and materials.

These considerations were deemed so important that Johns-Manville devoted a ten-year project to pyrolysis research and built a plant at Tilton, N. H. for the sole purpose of producing electrical insulations that would defy time and heat. The first of these insulations are the Quinterras.

Quinterras are basically inorganic sheets that possess thinness, flexibility, freedom from impurities, heat sta-

bility and dielectric strength to an extent never before attained in an asbestos-base material. These properties make them of particular value where high temperatures are encountered. They may be used for wrapping individual wires or groups of wires, as a separating dielectric between layers of coils, for lining slots in which magnetic coils are placed and many other insulation services where destructive heat may occur.

### Aids Space Factor in Equipment Design

The use of Quinterra\* greatly aids the space factor which is so important in the design of electrical equipment. The heat stability of Quinterra, which assures lasting high dielectric strength, permits thinner layers to be used to resist given voltage stresses. For the extra thickness of insulation, usually incorporated to compensate for loss of dielectric strength due to heat, can be eliminated.

\* Reg. U. S. Pat. Off.



### Compositions and Types of Quinterra

All types of Quinterra Electrical Insulations consist of an inorganic base sheet made entirely from highly purified asbestos fiber. This untreated base sheet is known as Type 1 Quinterra. The treated types have a saturant which is added primarily to impart essential mechanical strengths necessary for handling and application, also to provide the moisture resistance.

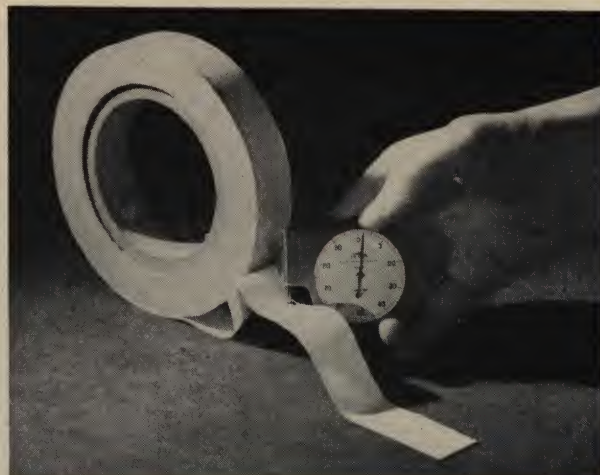
Although the various treated types of Quinterra differ from each other in the kind of saturant used, the base sheet is always the same. Type 3 Quinterra has a silicone resin saturant; Types 5 and 6 are saturated with polyvinyl acetate.

### How Quinterra Is Made

The untreated Quinterra (Type 1) is made from a specially selected Canadian Chrysotile asbestos fiber that has been almost completely freed of all conducting



*Quinterra Electrical Insulations are made on an intricate re-design of paper-making equipment*



*Quinterra is the first asbestos-base electrical insulation produced as tissue thin as a few mils*

elements such as magnetite and water soluble electrolytes. This extreme purification—so necessary to the dielectric strength as well as the flexibility and incombustibility of the finished sheet—is accomplished through a sorting and separating treatment developed particularly for this product. Originally, inorganic binders were used but through experimentation and development of the purification process, it was found that binders could be eliminated and the base sheet be made of pure asbestos. The highly purified fiber is formed into a sheet by a process which has been made possible through an intricate re-design of conventional paper making equipment. This process produces a sheet of uniform closed structure without holes but with sufficient porosity to absorb saturants. To prevent contamination, the water used is of high initial purity—one of the reasons why the plant site at Tilton, N. H. was selected. The special purifying and paper making equipment used assure a product of uniform mechanical and electrical properties . . . and make it possible to produce the basic, untreated, Type 1 Quinterra in sheets as thin as 2.6 mils.

This base sheet is saturated on specially designed equipment which provides complete process control and assures a uniform product throughout.



## Type 1 Quinterra—The Base Sheet



*The flame from an electrician's alcohol torch shows the incombustibility of basic, untreated Quinterra*

Basic, inorganic Quinterra® (Type 1) is characterized by extreme flexibility, incombustibility and high sustained dielectric strength. In fact, 90 percent of the dielectric strength of the treated forms of Quinterra is inherent in the base sheet.

The special fiber treating process reduces to a minimum the residual iron of the asbestos fibers and leaves them completely free of dirt and dust.

### Properties of Type 1 Quinterra — The Completely Inorganic Base Sheet

**Heat Stability** is a major property of all Quinterras because the base sheet is not harmed by temperature even up to 400 C. Temperatures of this order do not cause it to disintegrate and it retains nearly all its initial dielectric strength at such a temperature. However, like mica, it does become brittle around 450-500 C, because of the loss of water of crystallization.

This high heat stability of the base sheet is important because it means that Quinterra will retain its dielectric strength even after the organic or semi-organic saturant

is baked out. It can never carbonize in use or become a mere spacer without dielectric strength. In this, Quinterra differs from organic insulations which carbonize or are destroyed with the saturant. Even the inorganic base fabrics become mere spacers with low dielectric strength when the saturant or varnish is baked out.

Loss of protecting treatments also causes most base sheets to lose their moisture resistance. Here, again, Quinterra differs because not all of its moisture resistance is lost. This appears to be due to the fact that some of the non-conducting residue of the saturant remains and serves to seal some of the pores.

**Thermal Conductivity:** The thermal conductivity of Quinterra is excellent. This is because the asbestos fibers are packed closely together in a tight homogeneous structure. The numerous air cells that impede the transmission of heat through commercial asbestos thermal insulations are not present in Quinterra Electrical Insulation.

**Dielectric Strength** of the basic Type 1 Quinterra is higher than ordinarily associated with asbestos products. At room temperature, it is above 200 VPM



and, contrary to the behavior of most dielectrics where their value decreases with increasing temperature, Quinterra maintains its dielectric strength with increases in temperature to 300 C. The actual insulating value after application, as on wires, coils and other conductors, varies with the different methods used and the processing of the complete assemblies, but the last-

ing non-aging properties of Quinterra are unaffected.

Chemically, asbestos is well known for its inertness. Basic Quinterra (Type 1) is therefore highly resistant to corrosion. It will not rot or support fungus growth.

Mechanical and Electrical Properties of Type 1 Quinterra are as given in the following table covering Typical Test Data.

**Typical Test Data for Type I Quinterra**  
(All tests made after conditioning at 70F, 50% R.H.)

Thickness in Mils*			Approx. Average Wt, lb per 100 sq ft	Approx. Average Breaking Strength, lb per in. width, Machine Direction	Approx. Average Bursting Strength psi	Dielectric Breakdown Strength, Volts**	
Nom	Min	Max				Minimum	Average
2.6	2.2	3.0	0.9	0.35	0.80	650	750
3.5	3.1	3.9	1.3	0.45	0.85	850	1000
4.5†	4.0	4.8	1.7	0.75	1.15	1050	1250
5.4	4.9	5.9	2.2	0.80	1.25	1400	1650
6.3†	5.8	6.9	2.5	0.85	1.35	1650	1900
7.0†	6.3	7.7	2.8	1.00	1.45	1800	2150
8.1	7.3	8.9	3.2	1.15	1.50	2100	2500

\* Caliper measured (rest method) per TAPPI, T-411 or ASTM, D-645 Method A.

\*\* Dielectric Breakdown Strengths are ascertained in accordance with the ASTM Standard (short time) Test Method D 149-44. As follows: Samples are taken at intervals during all production runs. Each is tested for dielectric strength by increasing the impressed voltage on the sample at a uniform rate to breakdown. Five breakdown tests are made at various points on each sample. These values in volts are totaled and their average determined. This average is the dielectric strength of the sample. However, in case the range of breakdown values is broad, ASTM requires five additional breakdown values be determined and then the average of the ten values is the dielectric strength of the sample.

The Minimum Dielectric Breakdown Strength of the material is the lowest average value for any individual sample determined by the above method.

The Average Dielectric Breakdown Strength is the normal quality level which the material will average determined by the above method.

† Not a standard thickness. Supplied on special order only.



*The Johns-Manville plant at Tilton, New Hampshire, devoted to the manufacture of Quinterra Electrical Insulations*



## Type 3 Quinterra

### Properties of Type 3 Quinterra

Type 3, like all the treated types of Quinterra†, is made from Type 1 Quinterra, the inorganic base sheet consisting entirely of purified asbestos fiber. The special fiber treating process reduces to a minimum the residual iron of the asbestos fibers and leaves them completely dirt and dust free. This inorganic base sheet is treated with a silicone resin saturant, specially selected for its physical and electrical properties. Thus, Type 3 Quinterra is a class "H" electrical insulation as defined by A.I.E.E. Standards.

As is the case with the other treated types of Quinterra, Type 3 derives the bulk of its thermal stability and lasting dielectric strength from the base sheet. This inorganic base sheet, Type 1 Quinterra, combines "pyrolysis" resistance and lasting insulating value to a much greater extent than any other inorganic or high temperature, flexible base material. The essential physical strengths, necessary for economical applications, are imparted to the base sheet by the saturant. Also, the important property of moisture resistance is obtained from the saturant.

Silicone resins being thermo-setting will, under elevated temperatures, become fully cured and less flexible. To assure in Type 3 (as supplied) the flexibility necessary for easy handling, the amount of cure is carefully controlled at the plant. While further curing causes the resin to harden and become less flexible, it also increases the physical strengths and moisture resistance.

**Thermal Stability:** The maximum operating temperature of Type 3 is limited by the saturant which,

† Reg. U. S. Pat. Off.



Applying Quinterra to stick-wound, small transformer coils

when used with Quinterra, has a heat range from 180 C to 250 C continuous exposure depending upon conditions and application. Even when the saturant is partially decomposed due to exposures above its limit, Type 3 retains the inherent dielectric strength of the inorganic base sheet. This is in striking contrast with other high temperature electrical insulation.

**Dielectric Strength:** Type 3 Quinterra is different in this characteristic from other class "H" insulations. The inherent variations in caliper and weight of the inorganic base sheet naturally affect the finished treated sheet. Therefore, the dielectric strength of Type 3 is above 225 VPM.

These values, although not high, are constant. They are practically unaffected by exposure to high temperatures or to high humidity after high temperature. In contrast, other commercially available class "H" insulations lose at least a portion of their initial dielectric value as shown graphically by the following curves

#### Typical Test Data for Type 3 Quinterra

(All tests made after conditioning at 70F, 50% R.H.)

Nominal Thickness, Mils*	Thickness Range, Mils	Weight		Strengths		Dielectric Breakdown, volts**	
		Nominal	Range	Breaking, Mach. Dir., lb per in. width	Average Bursting, psi	Minimum	Average
3	2.7-3.2	1.5	1.2-1.6	5.7	9.2	800	1000
4	3.6-4.4	2.0	1.7-2.3	8.0	11.5	1100	1300
6	5.4-6.6	3.1	2.6-3.6	10.3	14.9	1500	1800
9	8.0-10.0	4.6	3.9-5.3	12.6	17.2	2200	2600

Stretch=3 percent.

Volume Resistivity=4.0 megamegohms-inches. ASTM D 257-46.

Dielectric Constant=5.0. ASTM D 150-47 Parallel Resistance, Substitution Circuit.

Power Factor, at 60 cycles=25 percent. ASTM D 150-47 Parallel Resistance, Substitution Circuit.

Average Electrical  
and  
Mechanical Values

\* Caliper measured (rest method) per TAPPI, T-411 or ASTM, D-645, Method A.

\*\* Dielectric Breakdown Strengths are ascertained in accordance with the ASTM Standard (short time) Test Method D 149-44. As follows: Samples are taken at intervals during all production runs. Each is tested for dielectric strength by increasing the impressed voltage on the sample at a uniform rate to breakdown. Five breakdown tests are made at various points on each sample. These values in volts are totaled and their average determined. This average is the dielectric strength of the sample. However, in case the range of breakdown values is broad, ASTM requires five additional breakdown values be determined and then the average of the ten values is the dielectric strength of the sample. The Minimum Dielectric Breakdown Strength of the material is the lowest average value for any individual sample determined by the above method.

The Average Dielectric Breakdown Strength is the normal quality level which the material will average determined by the above method.

QUINTERRA ELECTRICAL INSULATION—TYPE 3

April, 1953 (Cancelling sheet dated January, 1952)

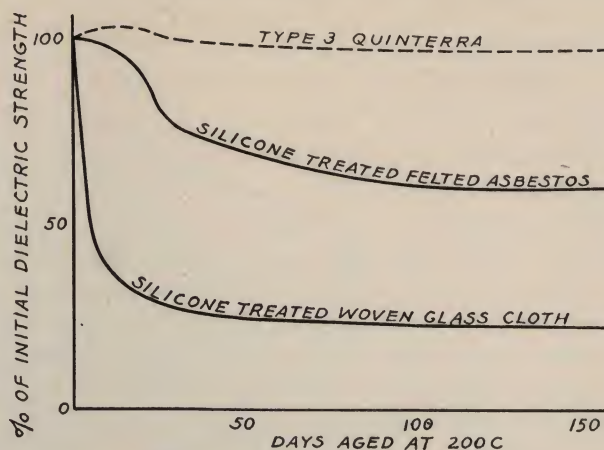
EL-363



based on the preliminary results of aging tests. It should be mentioned that on these tests silicone treated woven glass cloth has a much greater initial VPM than Type 3 Quinterra. However, the rate of loss upon exposure to 200 C was so great that after a few days Type 3 showed the higher dielectric strength.

**Mechanical Properties:** Actual usage has indicated that Type 3 Quinterra has sufficient mechanical strength for economical application in many types of electrical equipment. Reasonable care in handling is required but the extreme flexibility of Type 3 facilitates its usage. Unlike some class "H" insulations, Type 3 is resistant to cracking and crazing. This is due to the firm mechanical bond between the asbestos fibers of the base sheet and the selected silicone resin saturant, as well as the controlled, partially cured state in which Type 3 Quinterra is supplied. Flexibility is maintained at temperatures as low as minus 20 C but is reduced somewhat by further curing resulting from continued exposure to elevated temperatures. Such curing, however, increases mechanical strengths. The extent of curing depends upon temperature exposure as well as the actual amount of silicone resin in the sheet. Resin content will vary with the nominal thickness and also from run to run for the same nominal thickness due to the weight and thickness tolerances of the base sheet. Resin content by weight will range from about 15 percent to around 40 percent with the thinner grades having the higher percentages.

**Chemical Properties:** The chemical inertness of asbestos is widely known while the silicone, due to its molecular structure, is relatively inert. Type 3 Quinterra is therefore resistant to oxidation, chemical fumes,



dilute acids and alkalies, as well as oils. It is, however, affected by concentrated acids and solvents containing high percentages of aromatic or chlorinated hydrocarbons. Under normal conditions of usage it is non-corrosive and it also resists fungus growth.

Equipment insulated with Type 3 Quinterra can be treated with the silicone varnishes generally used for this purpose. It can also be combined or used as a backing with other materials to form flexible laminates.

**Moisture Resistance:** The moisture resistance of Type 3 Quinterra is good. Aging tests have indicated negligible loss in dielectric strength upon lengthy exposure to high humidity (91 percent R.H.). However, the power factor of the material is impaired under these conditions. For maximum moisture protection of equipment insulated with Type 3 Quinterra, the customary coating or impregnation with silicone varnish is therefore recommended.

#### Data for Standard Tapes and Rolls of Type 3 Quinterra Now Available

##### Approximate Weights and Yardage

Width in Inches	3 Mil Nom Thickness				4 Mil Nom Thickness				6 Mil Nom Thickness				9 Mil Nom Thickness			
	Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll	
	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core
¼	0.38	0.33	439	377	0.41	0.35	329	281	0.42	0.37	220	188	0.42	0.33	146	125
⅜	0.58	0.50	439	377	0.62	0.53	329	281	0.64	0.56	220	188	0.64	0.55	146	125
½	0.77	0.67	439	377	0.82	0.71	329	281	0.85	0.73	220	188	0.84	0.73	146	125
¾	1.15	0.99	439	377	1.23	1.05	329	281	1.29	1.10	220	188	1.26	1.04	146	125
⅞	3.24	2.93	1022	958	3.32	3.15	766	718	3.46	3.26	511	479	3.24	3.22	339	318
1	3.58	3.35	1022	958	3.81	3.58	766	718	3.97	3.75	511	479	3.90	3.70	339	318
1¼	4.48	4.20	1022	958	4.77	4.48	766	718	4.97	4.67	511	479	4.87	4.62	339	318
36	—	100.0	—	793	—	100.0	—	553	—	100.0	—	359	—	100.0	—	242

**Cut Sheets:** Widths ¼" thru 5" in lengths of 1" to, but not including 10"; widths over 5" thru 36" in lengths of 10" thru 60".

Tolerances—Widths of ¼" to 2", ± 1/64"; 2" and over, ± 1/16" per foot or fraction thereof.

Tolerances—Lengths (all), ± 1/16" per foot or fraction thereof.

**Roll Widths:** ¼" thru 6" in increments of 1/64"; 6" thru 36" in increments of 1/32".

Tolerances—¼" thru 6", ± 1/64"; over 6", ± 1/32".

**Core Size:** For tapes or rolls less than 36" wide, 1½" or 3" ID; for 36" rolls, 3" ID only.

**Roll Size:** For tapes, ¼" to ¾" wide, approximately 8" OD; for tapes and rolls over ¾" wide, approximately 10" to 14" OD.



## Types 5 and 5-2 Ply Quinterra

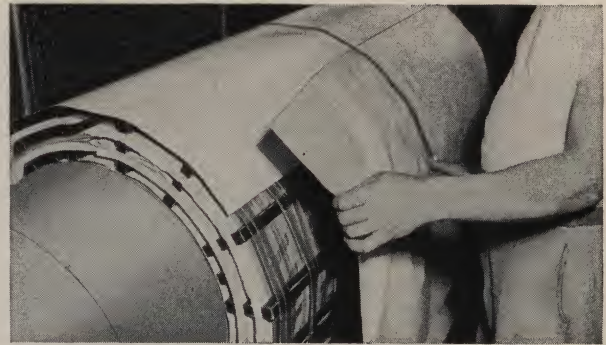
(Type 5-2Ply formerly called Type 6)

Types 5 and 5-2Ply Quinterra®, like all of the treated Types, are made from Type 1, the inorganic base sheet of purified asbestos fiber. They have the same type of saturant—polyvinyl acetate. Their only difference is that Type 5 is a single sheet while Type 5-2Ply is composed of two sheets of Type 5 combined and calendered together under controlled temperature and pressure to form a duplex sheet.

These treated types of Quinterra derive the bulk of their thermal stability and dielectric strength from the base sheet (Type 1) which has these properties to an extent not possessed by any other inorganic or high temperature flexible base material.

### Properties

**Thermal Stability:** The maximum operating temperature of Types 5 and 5-2Ply is limited by the saturant which has a heat range from 130 to 170 C continuous depending upon conditions and application. Therefore, they are electrical insulations which can be safely used in certain applications where a higher temperature prevails than that of the usual 130 C, Class B, materials. Even when the saturant has been baked out by continuous exposure to extremely high temperatures, Types 5 and 5-2Ply retain the inherent



Types 5 and 5-2Ply Quinterra are used as layer and outer barrier insulation in dry-type transformers

dielectric strength of the base sheet. In this, both types differ from other high temperature electrical insulations which are destroyed with the departure of the saturant.

**Dielectric Strength:** Type 5 has a dielectric strength of above 220 VPM. It retains this strength even after continuous exposure to 200 C, differing from other electrical insulations which do not retain their initial dielectric strength under conditions of high heat and humidity. Type 5-2Ply has a slightly higher dielectric strength of above 280 VPM because of its greater density.

**Chemical Properties:** Type 5 and Type 5-2Ply Quinterra have the same basic properties as the base

#### Typical Test Data for Type 5 Quinterra

(All tests made after conditioning at 70F, 50% R.H.)

Nom Thickness, Mills*	Thickness Range, Mills	Weight, lb per 100 sq ft	Strengths				Dielectric Breakdown, volts
			Breaking, Mach. Dir. lb per in. width	Avg Bursting, psi			
3	2.7-3.3	1.6	1.3-1.9	8.0	11.5	800	900
4	3.6-4.4	1.9	1.5-2.3	10.3	15.0	1100	1300
5†	4.5-5.5	2.4	1.8-3.0	12.6	18.5	1400	1600
6	5.4-6.6	2.8	2.3-3.4	14.0	20.7	1600	1900
7†	6.3-7.7	3.4	2.9-3.9	15.5	23.0	1900	2200
8†	7.2-8.8	3.8	3.3-4.3	16.1	25.0	2000	2400
9	8.0-10.0	4.1	3.5-4.8	15.0	25.5	2200	2600

#### Typical Test Data for Type 5-2Ply Quinterra

(All tests made after conditioning at 70F, 50% R.H.)

Nom Thickness, Mills*	Thickness Range, Mills	Weight, lb per 100 sq ft	Strengths				Dielectric Breakdown, volts
			Breaking, Mach. Dir. lb per in. width	Avg Bursting, psi			
4.5	4.0-5.0	3.0	2.5-3.5	17.5	25.0	1500	1800
6.0	5.1-6.6	3.8	3.1-4.5	20.0	32.5	1900	2300
7.0†	6.3-7.7	4.5	3.8-5.2	25.0	37.5	2300	2700
8.0†	7.2-8.8	5.0	4.2-5.8	27.5	41.2	2700	3200
9.0†	8.1-9.9	5.4	4.6-6.2	30.0	45.0	3000	3500
10.0	9.0-11.0	6.1	5.2-7.1	32.5	50.0	3200	3800
12.0†	10.8-13.2	7.3	6.2-8.4	33.7	52.5	3700	4400
15.0	13.5-16.5	8.4	7.1-9.7	35.0	57.5	4400	5200

† Not a standard thickness. Supplied on special order only.

#### Average Electrical and Mechanical Values:

	Type 5	Type 5-2Ply
Volume Resistivity (ASTM D 257-46)	0.55 megamegohms-inches	2.8 megamegohms-inches
Dielectric Constant (ASTM D 150-47 Parallel Resistance Substitution Circuit 5.0)	5.0	6.0
Power Factor, at 60 cycles		
(ASTM D 150-47 Parallel Resistance Substitution Circuit)	35 percent	25 percent
Specific Impedance	1500 megohms-inches	1500 megohms-inches
Stretch	4 percent	3 percent

\* Caliper measured (rest method) per TAPPI, T-411 or ASTM, D-645 Method A.

† Dielectric Breakdown Strengths are ascertained in accordance with the ASTM Standard (short time) Test Method D 149-44. As follows: Samples are taken at intervals during all production runs. Each is tested for dielectric strength by increasing the impressed voltage on the sample at a uniform rate to breakdown. Five breakdown tests are made at various points on each sample. These values in volts are totaled and their average determined. This average is the dielectric strength of the sample. However, in case the range of breakdown values is broad, ASTM requires five additional breakdown values be determined and then the average of the ten values is the dielectric strength of the sample.

The Minimum Dielectric Breakdown Strength of the material is the lowest average value for any individual sample determined by the above method.

The Average Dielectric Breakdown Strength is the normal quality level which the material will average determined by the above method.



sheet (Type 1) and, like it, resist corrosion and will not rot or support fungus growth. They resist acid and alkali fumes. They are unharmed by straight chain parafins used in transformer coolants but the saturant is slowly dissolved by coolants containing high percentages of cyclic or chlorinated hydrocarbons. However, a small percent of such hydrocarbons has only a slight softening effect, not electrically detrimental. They are usable with most all of the insulating varnishes used in coating wires, coils or other electrical assemblies

if the drying or baking temperatures used do not exceed 150 C and are not of more than 3 hours duration.

Moisture Absorption of Type 5 under total immersion is relatively high but that of Type 5-2Ply, due to its greater density, is a little less. However, the dielectric strength of these Quinterras is not significantly impaired by high humidity even after exposure to temperatures up to 150 C. Additional protection from moisture may be provided by the customary treatment with insulating varnish.

*Data for Standard Tapes and Rolls of Type 5 Quinterra Now Available*

Approximate Weights and Yardage (7 Mil on special order only)																				
Width in Inches	3 Mil Nom Thickness				4 Mil Nom Thickness				6 Mil Nom Thickness				7 Mil Nom Thickness				9 Mil Nom Thickness			
	Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll	
	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core
¼	0.43	0.38	439	377	0.39	0.33	329	281	0.38	0.33	220	188	0.40	0.34	188	162	0.38	0.30	146	125
⅜	0.66	0.57	439	377	0.59	0.50	329	281	0.58	0.50	220	188	0.60	0.52	188	162	0.58	0.50	146	125
½	0.88	0.76	439	377	0.78	0.67	329	281	0.77	0.66	220	188	0.80	0.69	188	162	0.77	0.67	146	125
¾	1.31	1.13	439	377	1.17	1.00	329	281	1.16	0.99	220	188	1.20	1.03	188	162	1.15	1.00	146	125
⅞	3.57	3.35	1022	958	3.16	2.98	766	718	3.12	2.94	511	479	3.26	3.06	438	412	3.12	2.92	339	318
1	4.03	3.83	1022	958	3.63	3.41	766	718	3.58	3.38	511	479	3.73	3.54	438	412	3.56	3.34	339	318
1¼	5.11	4.80	1022	958	4.54	4.27	766	718	4.48	4.22	511	479	4.66	4.37	438	412	4.45	4.18	339	318
36	—	100.0	—	695	—	100.0	—	583	—	100.0	—	397	—	100.0	—	327	—	100.0	—	265

*Data for Standard Tapes and Rolls of Type 5-2Ply Quinterra Now Available*

Approximate Weights and Yardage (7, 8, 9 and 12 Mil on special order only)																
Width in Inches	4.5 Mil Nom Thickness				6 Mil Nom Thickness				7 Mil Nom Thickness				8 Mil Nom Thickness			
	Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll	
	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core
¼	0.55	0.48	296	255	0.51	0.43	220	188	0.53	0.45	188	162	0.52	0.45	166	144
⅜	0.83	0.72	296	255	0.76	0.65	220	188	0.80	0.68	188	162	0.78	0.68	166	144
½	1.11	0.96	296	255	1.02	0.87	220	188	1.06	0.91	188	162	1.04	0.90	166	144
¾	1.67	1.44	296	255	1.57	1.31	220	188	1.59	1.36	188	162	1.56	1.35	166	144
⅞	4.66	4.22	713	643	4.11	3.87	511	479	4.32	4.05	438	412	4.45	3.93	407	360
1	5.33	4.82	713	643	4.73	4.43	511	479	4.93	4.63	438	412	5.09	4.50	407	360
1¼	6.73	6.03	713	643	5.92	5.53	511	479	6.17	5.80	438	412	6.35	5.62	407	360
36	—	100.0	—	370	—	100.0	—	300	—	100.0	—	245	—	100.0	—	223
	9 Mil Nom Thickness				10 Mil Nom Thickness				12 Mil Nom Thickness				15 Mil Nom Thickness			
	Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll		Weight Lb Per Roll		Yards Per Roll	
	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core	1½" core	3" core
¼	0.49	0.42	146	125	0.51	0.43	134	113	0.50	0.43	110	95	0.47	0.39	89	75
⅜	0.74	0.63	146	125	0.75	0.65	134	113	0.75	0.65	110	95	0.70	0.59	89	75
½	0.99	0.85	146	125	1.02	0.86	134	113	1.00	0.87	110	95	0.94	0.79	89	75
¾	1.48	1.27	146	125	1.53	1.29	134	113	1.51	1.30	110	95	1.40	1.18	89	75
⅞	4.40	3.76	339	318	4.11	3.82	308	286	4.08	3.81	256	239	3.78	3.51	205	191
1	5.03	4.30	339	318	4.70	4.37	308	286	4.67	4.36	256	239	4.30	4.02	205	191
1¼	6.30	5.36	339	318	5.88	5.45	308	286	5.85	5.45	256	239	5.38	5.02	205	191
36	—	100.0	—	209	—	100.0	—	182	—	100.0	—	152	—	100.0	—	132

#### Standard Sizes

- Cut Sheets:** Widths ¼" thru 5" in lengths of 1" to, but not including 10"; widths over 5" thru 36" in lengths of 10" thru 60".  
Tolerances—Widths of ¼" to 2", ± 1/64"; 2" and over, ± 1/16" per foot or fraction thereof.  
Tolerances—Lengths (all), ± 1/16" per foot or fraction thereof.
- Roll Widths:** ¼" to 6" in increments of 1/64"; 6" thru 36" in increments of 1/32".  
Tolerances, ¼" thru 6", ± 1/64"; over 6", ± 1/32".
- Core Size:** For tapes or rolls less than 36" wide, 1½" or 3" ID; for 36" rolls, 3" ID only.
- Roll Size:** For tapes, ¼" to ¾" wide, approximately 8" OD; for tapes and rolls over ¾" wide, approximately 10" to 14" OD.



# Type 3 GR Quinterra

(Glass Cloth Reinforced — A Class "H" Insulation)

Quinterra® Type 3 GR is a superior Class "H" electrical insulation for use where exposure to extremely high temperatures is encountered. In actual use it remains thermally stable at temperatures up to 250 C—better than the Class "H" maximum of 180 C.

Type 3 GR Quinterra, manufactured in duplex construction, consists of a sheet of standard Type 3 Quinterra backed with tightly woven glass cloth and bonded with silicone adhesive. The components of this dependable Class "H" product—a base sheet of 100 percent highly purified asbestos saturated with silicone resin, glass cloth and silicone adhesive—are materials that assure long life and temperature stability. From basic Quinterra, the composite sheet obtains pyrolysis resistance and lasting dielectric strength, and from glass cloth, exceptional tear, bursting and tensile strength. As with all Quinterra products in combined form, the superior electrical properties imparted by the Tilton process are retained and considerable mechanical strength added by the glass cloth. In addition, the use of a special high-count glass cloth provides a smooth, abrasive-resistant surface to the finished sheet.

General uses for Type 3 GR include Motor Repair

## Physical and Electrical Values\* for Type 3 GR Quinterra

(All samples conditioned at 70 F, 50% R.H.)

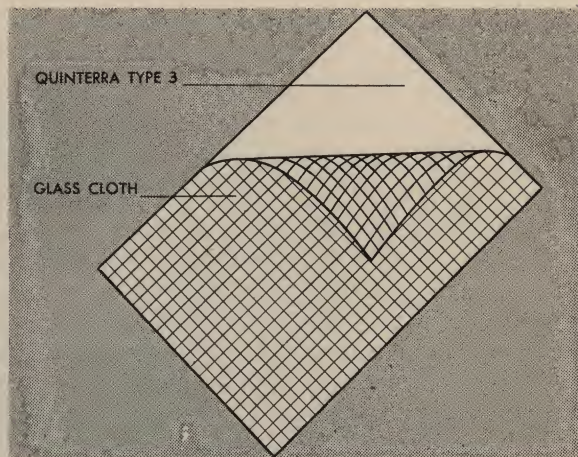
Nominal Thickness, Mils ( $\pm 10\%$ ) **	7.5	10	13
Average Weight, lb per 100 sq ft ( $\pm 15\%$ )	4.3	5.9	7.4
Breaking Strength—			
Machine Direction, lb per in. width	90	125	135
Cross Direction, lb per in. width	80	100	100
Tear (Machine Direction), grams	600+	800+	800+
Bursting Strength (Mullen), psi	60+	60+	60+
Dielectric Strength, total volts	1000	1800	2400
Vol. Resistivity†, megamegohms-inches	6.0	6.0	6.0
Dielectric Constant††	5.0	5.0	5.0
Power Factor††, percent	10	10	10
Specific Impedance, megohms-inches	2800	2800	2800

\* These are laboratory values given only to indicate approximate properties and are not to be used for specifications.

\*\* Caliper measured (rest method) per TAPPI, T-411 or ASTM, D-645, Method A.

† Test method, ASTM D257-46.

†† Test method, ASTM D150-47, Parallel Resistance Substitution Circuit.



Illustrating the construction of Type 3 GR Quinterra, a Class "H" Insulation

Shops, Motor and Generator Manufacturers as well as Transformer, Solenoid Equipment and Cable Manufacturers working with Class "H" equipment. Specific uses include phase separators, slot liners, layer, barrier and wrapper insulation, inter-coil insulation, rotor-bar wrapping, binding tapes for motor coils and cable wrapping.

Type 3 GR Quinterra is supplied in nominal thicknesses of 7.5, 10 and 13 mils. To achieve these thicknesses, nominal sheets of 3, 6 and 9-mil Type 3 Quinterra are combined with glass cloth.

All thicknesses are supplied on direct sales to the electrical industry in rolls, sheets and tapes. In addition, they are packaged in small rolls and tapes for sale through Electrical Insulation Distributors.

## Approximate Lengths of Standard Rolls, Yards

Width in Inches	Type 3 GR Quinterra					
	7.5-Mil		10-Mil		13-Mil	
	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core
¾	178	149	134	113	105	88
⅞	404	367	308	286	236	221
1¼	404	367	308	286	236	221
36	—	258	—	187	—	150

(Available Thicknesses, Forms and Sizes shown on the reverse of this sheet)



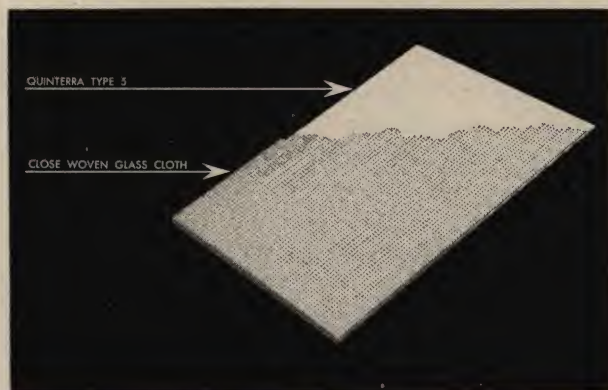
*Available Thicknesses, Forms and Sizes*

For Direct Sale to Industrial Users	Small Rolls and Tapes Packaged for Sale Through Electrical Insulation Distributors
Thicknesses: 7.5-mil (0.0075"), 10-mil (0.010"), 13-mil (0.013")	Thicknesses: 7.5-mil (0.0075"), 10-mil (0.010"), 13-mil (0.013")
Forms: Sheets and Rolls*	Rolls: 18" wide; 36, 72 and 144 yards long 36" wide; 144 yards long
Cut Sheets: Widths of ½" thru 5", in lengths of 1" to, but not including 10"; over 5" thru 36", in lengths of 10" thru 60"	Cores: 18" width, 1½" Inside Diameter 36" width, 3" Inside Diameter
Rolls: Widths—½" thru 36", in increments of ⅛" Lengths—per preceding table Outside diameters—for widths ½" thru ¾", approx. 8"; for widths over ¾", approx. 10" thru 14"	Tapes: Widths of ½", ¾" and 1" Lengths of 36, 72 and 144 yards Cores: ⅜" Inside Diameter; Thicker Tapes use 1½" Inside Diameter and Adaptor to reduce to ⅜"
Cores: 1½" or 3" ID for rolls less than 36" wide; 3" ID only for 36" wide rolls	Cut Sheets: 36" x 36"
Tolerances: Widths and Lengths, ± ⅛" per foot or fraction thereof	Tolerances: Width and Cut Sheet Length, ± ⅛" per foot or fraction thereof Roll Length, — 0, + 1 yard

\* Sheets, Rolls and Cores in sizes other than shown, on special order.



## Types 5 GR and 5 GL Quinterra



*Type 5 GR Quinterra*

### Type 5 GR Quinterra

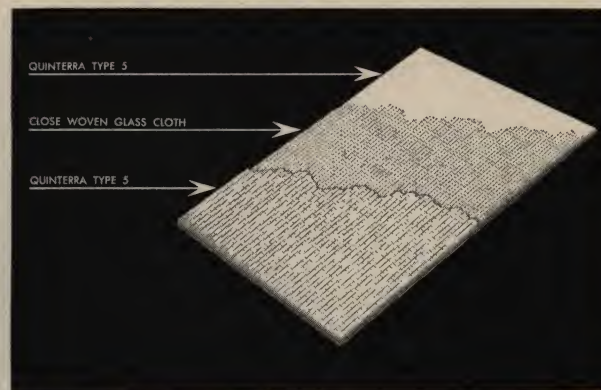
*(Glass Cloth Reinforced—A Class “B” Insulation)*

Quinterra® Type 5 GR is a high quality, asbestos base Class “B” electrical insulation treated and reinforced for strength and durability. The composite materials—100 percent highly purified asbestos sheets saturated with polyvinyl acetate, close woven glass cloth and polyvinyl acetate adhesive—assure good pyrolysis resistance and thermal stability beyond the Class “B” temperature limit of 130 C. Actually, Type 5 GR Quinterra withstands temperatures to 150 C and resists delamination at even higher temperatures.

In the duplex construction, a continuous sheet of standard Type 5 Quinterra is bonded with a polyvinyl acetate adhesive to 4.3-mil close woven glass cloth. The finished product, therefore, has one smooth side and the other side with a fine screen surface. Besides affording an economical method of reinforcing and strengthening the Type 5 Quinterra, the glass cloth provides one surface with the abrasive resistance of glass.

Type 5 GR Quinterra is available in four nominal thicknesses: 6.5, 7.5, 9.5 and 12.5 mil. For 6.5-mil thick material, nominal 3-mil Type 5 Quinterra is used; for 7.5-mil, nominal 4-mil Type 5 Quinterra; for 9.5-mil, nominal 6-mil Type 5 Quinterra; and for 12.5 mil, 9-mil Type 5 Quinterra is used. In the combining process, the two sheets are calendered slightly and the glass cloth tends to smooth out because of the adhesive between the threads.

As with all modifications to the basic Quinterra, Type 5 GR possesses the lasting, inherent dielectric strength and pyrolysis resistance imparted to the base sheet by the special Tilton fiber-purifying process. Combining with glass cloth assures high tensile strength



*Type 5 GL Quinterra*

and tear resistance in both machine and cross-machine direction. In addition, the total dielectric breakdown strength of the finished product is comparable to the Type 5 Quinterra used.

Type 5 GR Quinterra is intended for the motor repair, motor and generator manufacturing and similar fields which require greater mechanical strength than standard Type 5 Quinterra can offer. Type 5 GR is used for coil insulation, slot liners, phase separators, rotor bar wrapping, binding tapes for motor coils, and layer or wrapper insulation in transformer windings.

### Type 5 GL Quinterra

*(Glass Cloth Laminated—A Class “B” Insulation)*

Quinterra Type 5 GL is a premium quality, treated and reinforced, asbestos base insulation for the Class “B” electrical insulation field. It withstands temperatures up to 150 C, considerably above the 130 C maximum for Class “B”. In service, it resists delamination at even higher temperatures. While differing in construction from Type 5 GR, the composite materials of Type 5 GL are the same: a highly purified 100 percent asbestos base sheet saturated with polyvinyl acetate, close woven glass cloth, and polyvinyl adhesive binder.

Type 5 GL, manufactured in triplex construction, consists of a sheet of 4.3-mil close woven glass cloth sandwiched between two continuous sheets of standard Type 5 Quinterra—all securely laminated with polyvinyl acetate adhesive for a lasting bond. In this triplex construction, squeeze or pressure rolls are employed and a relatively dense sheet results. A nominal thickness of Type 5 GL contains approximately one and one-half times the amount of standard Quinterra as the same caliper of Type 5 GR. Because of the greater density and Quinterra content, Type 5 GL possesses a



considerably higher dielectric breakdown strength than Type 5 GR.

Quinterra Type 5 GL is supplied in nominal thicknesses of 8.5, 10.5, 14 and 20 mil. These nominal thicknesses are attained by combining the following thicknesses of Standard Type 5 Quinterra with the glass cloth: 8.5 mil—two sheets of 3-mil Type 5; 10.5 mil—two sheets of 4-mil Type 5; 14 mil—two sheets of 6-mil Type 5; and 20 mil—two sheets of 9-mil Type 5.

The fundamental property of all Quinterra products is inherent pyrolysis resistance. Derived from the highly purified base sheet, this desirable characteristic is retained despite modifications to the sheet for additional mechanical strength. Type 5 GL Quinterra provides a combination of lasting dielectric, high tensile strength, good tear resistance and enduring lamination. Like all reinforced Quinterra products, Type 5 GL retains electrical properties comparable to the Type 5 Quinterra sheets used.

Type 5 GL Quinterra is used for essentially the same purposes as Type 5 GR—motor repair shops, motor and generator manufacturers and other electrical insulation applications where the standard Type 5 Quinterra lacks the required physical strength.

Type 5 GR provides a mechanically strong product at a minimum coverage cost. Type 5 GL serves where higher dielectric strength and two smooth surfaces as well as physical durability are essential. Uses for Type 5 GL include coil insulation, slot liners, phase separators, rotor bar wrapping, binding tape for motor coils and layer or wrapper insulation in transformer windings.

#### Available Thicknesses, Forms and Sizes

##### Thicknesses:

Type 5 GR—6.5 mil (0.0065"), 7.5 mil (0.0075"), 9.5 mil (0.0095"), 12.5 mil (0.0125")

Type 5 GL—8.5 (0.0085"), 10.5 mil (0.0105"), 14 mil (0.014"), 20 mil (0.020")

##### Forms: Sheets and Rolls\*

Cut Sheets: Widths of  $\frac{1}{2}$ " thru 5", in lengths of 1" to, but not including 10"; over 5" thru 36", in lengths of 10" thru 60".

Rolls: Widths— $\frac{1}{2}$ " thru 36", in increments of  $\frac{1}{16}$ ".

Lengths—see table below.

Outside Diameters—for width  $\frac{1}{2}$ " to  $\frac{3}{4}$ ", approx. 8";

for widths over  $\frac{3}{4}$ ", approx. 10" thru 14".

Cores:  $1\frac{1}{2}$ " or 3" ID for rolls less than 36" wide; 3" ID only for 36" wide rolls.

Tolerances: Width and Length— $\pm \frac{1}{16}$ " per ft or fraction thereof.

\* Sheets, Rolls and Cores in sizes other than shown, on special order.

#### Approximate Lengths of Standard Rolls, Yards\*

Width in Inches	Type 5 GR Quinterra								Type 5 GL Quinterra							
	6.5 Mil		7.5 Mil		9.5 Mil		12.5 Mil		8.5 Mil		10.5 Mil		14 Mil		20 Mil	
	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core	$1\frac{1}{2}$ " Core	3" Core
$\frac{3}{4}$	206	173	177	149	142	119	108	91	158	133	126	108	124	80	67	56
$\frac{7}{8}$	470	436	404	376	315	293	246	263	361	336	289	271	220	204	155	144
$1\frac{1}{4}$	470	436	404	376	315	293	246	263	361	336	289	271	220	204	155	144
36	—	346	—	308	—	232	—	185	—	221	—	173	—	139	—	101

\* Estimated figures, not for specification.

#### Physical and Electrical Properties\*

(All samples conditioned at 70 F, 50% R.H.)

	Type 5 GR Quinterra				Type 5 GL Quinterra			
Nominal Thickness, Mils ( $\pm 10\%$ )**	6.5	7.5	9.5	12.5	8.5	10.5	14	20.0
Average Weight, lb per 100 sq ft ( $\pm 15\%$ )	3.2	3.6	4.8	6.0	5.0	6.4	8.0	11.0
Breaking Strength, lb per in. width	70	110	120	140	130	140	150	160
Tear, grams	380	400	420	430	450	480	500	550
Bursting Strength (Mullen), psi	175	185	215	220	325	330	340	356
Dielectric Strength, total volts	900	1000	1600	2300	2000	2800	3500	5000
Vol. Resistivity†, megamegohms-inches	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Dielectric Constant††	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Power Factor††, percent	20	20	20	20	20	20	20	20
Specific Impedance, megohms-inches	2000	2000	2000	2000	2000	2000	2000	2000

\* These are laboratory values given only to indicate approximate properties and are not to be used for specifications.

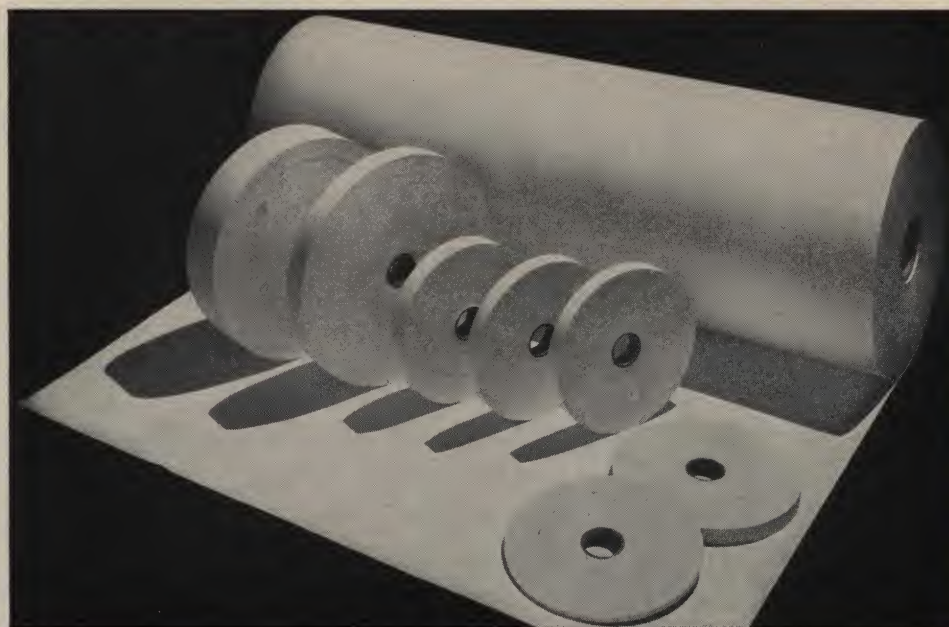
\*\* Caliper measured (rest method) per TAPPI, T-411 or ASTM, D-645, Method A.

† Test method, ASTM D257-46.

†† Test method, ASTM D150-47, Parallel Resistance Substitute Circuit.



## Quinorgo Electrical Insulations



*Quinorgo Electrical Insulations are available in tapes, rolls or sheets*

Quinorgo\* Electrical Insulations are heat-resistant dielectric sheet materials designed for use in electrical equipment which operates at temperatures up to 130 C, the top limit for Class "B" electrical insulations. Quinorgo contains over 83 percent of specially processed, highly purified, asbestos fibers with less than 17 percent of selected organic materials used as the binder. The special fiber-treating process reduces to a minimum the residual iron of the asbestos fibers and leaves them completely free of dirt and dust.

The Quinorgo Electrical Insulations may be readily treated or combined with reinforcing materials, either organic or inorganic, such as cambric, glass cloth or organic electrical papers. At present, two types of Quinorgo insulation are available: No. 3000 and No. 4000. Quinorgo No. 3000 is absorbent, especially in the thinner calipers, which permits impregnation by many of the conventional oil base or synthetic base dielectrics used in waterproofing materials. Quinorgo No. 4000 is a slightly modified version of No. 3000 in that it contains approximately 3 percent of resin which slightly reduces its absorption and penetration characteristics. No. 4000 may be coated on one surface with shellac or varnish to permit bonding or cementing to it such mechanically or dielectrically stronger materials as inorganic woven cloth and mica or organic cellulose film and sheets. The bonding coat applied to

one surface does not tend to strike through to the other, which leaves it ready for absorption of treating varnishes used in the further processing of equipment after the composite insulation has been applied.

These insulations may be stocked over long periods without deterioration. Being naturally porous, however, they should be either maintained in a dry or heated storage space or should be dried before impregnation. When rolls of these materials have been impregnated or treated before storage, they should be given a slight drying cycle before using, depending upon the known protective ability of the particular varnish used and efficiency of the storage facilities to preclude moisture absorption.

Quinorgo Electrical Insulations are available in either roll or tape form or in cut sheets. The standard roll is 36" wide and weighs 125 lb,  $\pm$  15 percent. For manufacturers who saturate the insulations prior to use in their equipment, or combine these insulations with other materials such as mica, or saturate them for other equipment users, 125-lb rolls with a trimmed width of 37" can be supplied. Tapes and rolls are furnished in standard widths from  $\frac{1}{4}$ " to 36". Cut sheets are furnished in widths from  $\frac{1}{4}$ " to 36" and lengths from 1" to 60". Width and length tolerances for tapes, rolls and sheets vary with dimensions as indicated in the table of "Standard Sizes" following.

\* Reg. U. S. Pat. Off.



## Standard Sizes

**Core Size:** For tapes or rolls less than 36" wide, 1½" or 3" ID; for 36" or 37" rolls, 3" ID only.

**Roll Size:** For tapes, ¼" to ¾" wide, approximately 8" OD; for tapes and rolls ⅞" and over, approximately 10" to 14".

**Cut Sheets:** Widths ¼" thru 5" by lengths of 1" to 10"; widths over 5" thru 36" by lengths of 10" thru 60". Other sizes supplied on S.P.I.

**Tolerances:** For Tapes and Rolls—widths from ¼" to and including 6",  $\pm \frac{1}{64}$ "; 6" to and including 36",  $\pm \frac{1}{32}$ ".  
For Cut Sheets—widths from ¼" to but not including 2",  $\pm \frac{1}{64}$ "; 2" to and including 36",  $\pm \frac{1}{16}$ " per foot or fraction thereof.  
Lengths from 1" to and including 60",  $\pm \frac{1}{16}$ " per foot or fraction thereof.

## Physical and Electrical Qualities of Quinorgo No. 3000 and No. 4000 Electrical Insulations

	5 Mil Thick (Nom.)		7 Mil Thick (Nom.)		10 Mil Thick (Nom.)		15 Mil Thick (Nom.)	
	No. 3000	No. 4000	No. 3000	No. 4000	No. 3000	No. 4000	No. 3000	No. 4000
Thickness, Range . . . . .	4.5-5.5	4.5-5.5	6.3-7.7	6.3-7.7	9.0-11.0	9.0-11.0	13.5-16.5	13.5-16.5
Wt, lb per 100 sq ft, Nominal .	1.8	2.0	2.6	2.9	3.8	4.2	5.8	6.3
Range . . . . .	1.5-2.1	1.7-2.3	2.2-3.0	2.5-3.4	3.2-4.4	3.5-4.8	4.9-6.7	5.4-7.3
Breaking Strength, lb per inch width,								
Avg Machine Direction . . .	12.0	17.5	13.2	21.2	19.2	25.0	21.6	28.7
Avg Cross Machine Direction .	5.0	8.0	6.0	11.0	7.0	12.0	8.0	13.0
Bursting Strength, psi, avg. . .	8.4	12.5	9.6	18.7	14.4	25.0	16.8	31.2
Dielectric Breakdown Strength*,								
volts, minimum . . . . .	1200	1300	1500	1600	2000	2000	2900	2900
volts, average . . . . .	1400	1500	1800	1900	2400	2400	3300	3300

\* Dielectric Breakdown Strengths are ascertained in accordance with the ASTM Standard (short time) Test Method D 149-44. As follows: Samples are taken at intervals during all production runs. Each is tested for dielectric strength by increasing the impressed voltage on the sample at a uniform rate to breakdown. Five breakdown tests are made at various points on each sample. These values in volts are totaled and their average determined. This average is the dielectric strength of the sample. However, in case the range of breakdown values is broad, ASTM requires five additional breakdown values be determined and then the average of the ten values is the dielectric strength of the sample.

The Minimum Dielectric Breakdown Strength of the material is the lowest average value for any individual sample determined by the above method.

The Average Dielectric Breakdown Strength is the normal quality level which the material will average determined by the above method.

## Quinorgo No. 3000 Electrical Insulation, Rolls and Tapes

## Approximate Weights and Yardage

Width in Inches	5 Mil Thick (Nom.)				7 Mil Thick (Nom.)				10 Mil Thick (Nom.)				15 Mil Thick (Nom.)			
	Wt Lb Per Roll		Yards Per Roll		Wt Lb Per Roll		Yards Per Roll		Wt Lb Per Roll		Yards Per Roll		Wt Lb Per Roll		Yards Per Roll	
	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"
	core	core	core	core	core	core	core	core	core	core	core	core	core	core	core	core
¼	0.30	0.25	268	226	0.30	0.26	188	161	0.32	0.27	134	113	0.32	0.27	89	75
½	0.60	0.51	268	226	0.61	0.52	188	161	0.64	0.54	134	113	0.65	0.54	89	75
¾	2.47	2.26	627	574	2.50	2.33	440	410	2.56	2.45	308	286	2.60	2.42	205	191
1¼	3.52	3.23	627	574	3.58	3.33	440	410	3.66	3.39	308	286	3.72	3.46	205	191
36	—	125	—	652	—	125	—	465	—	125	—	326	—	125	—	217

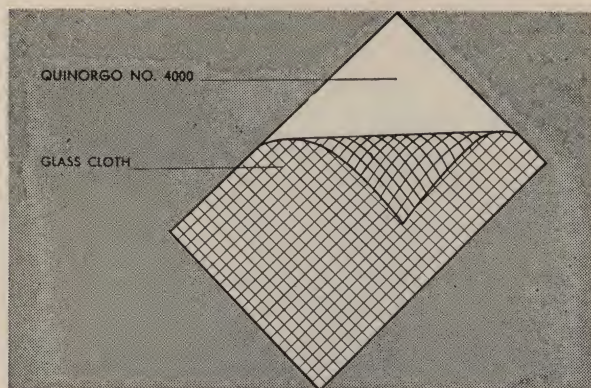
## Quinorgo No. 4000 Electrical Insulation, Rolls and Tapes

## Approximate Weights and Yardage

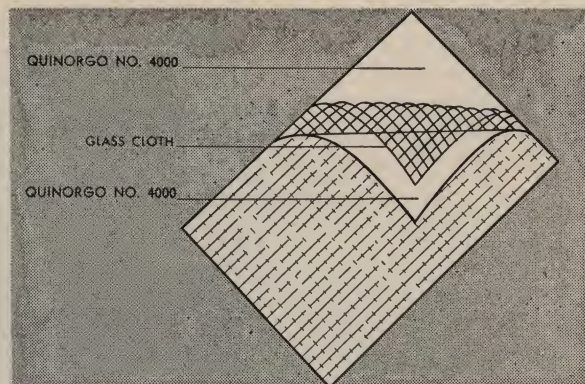
Width in Inches	5 Mil Thick (Nom.)				7 Mil Thick (Nom.)				10 Mil Thick (Nom.)				15 Mil Thick (Nom.)			
	Wt Lb Per Roll		Yards Per Roll		Wt Lb Per Roll		Yards Per Roll		Wt Lb Per Roll		Yards Per Roll		Wt Lb Per Roll		Yards Per Roll	
	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"	1½"	3"
	core	core	core	core	core	core	core	core	core	core	core	core	core	core	core	core
¼	0.33	0.28	268	226	0.35	0.29	188	161	0.35	0.38	134	113	0.35	0.30	89	75
½	0.67	0.54	268	226	0.69	0.59	188	161	0.70	0.60	134	113	0.70	0.59	89	75
¾	0.72	2.52	627	574	2.82	2.63	440	410	2.82	2.60	308	286	2.84	2.65	205	191
1¼	3.89	3.50	627	574	4.02	3.75	440	410	4.02	3.71	308	286	4.44	3.78	205	191
36	—	125	—	653	—	125	—	465	—	125	—	326	—	125	—	217



## No.4000 GR and GL Quinorgo



No.4000 GR Quinorgo



No.4000 GL Quinorgo

### No.4000 GR Quinorgo

*(Glass Cloth Reinforced—A Class "B" Insulation)*

Quinorgo® No.4000 GR is an asbestos base, Class "B", electrical insulation reinforced with glass cloth for strength and durability. Made in duplex construction, it consists of a sheet of standard No.4000 Quinorgo backed with tightly woven glass cloth and bonded with polyvinyl acetate adhesive. Type No.4000 Quinorgo is an untreated sheet containing not less than 85 percent highly purified asbestos fiber. A small amount of polyvinyl acetate resin in the furnish of the sheet facilitates controlled saturation. Composites of No.4000 Quinorgo base sheet and glass cloth are very well adapted to coating or treating with the various electrical insulation varnishes and resins.

The duplex construction of No.4000 GR Quinorgo affords a high strength insulation at minimum cost and has the additional advantage of providing an exterior surface of smooth, high-count glass cloth with excellent abrasion resistance. In the thinner grades, No.4000 GR Quinorgo is extremely flexible, while the thicker calipers are relatively stiff. No.4000 GR Quinorgo performs adequately through the temperature range of Class "B" Insulation (max operating temperature 130 C).

It is supplied in nominal thicknesses of 7-, 10-, 13- and 16-mils. To achieve these finished sizes, glass cloth is combined with No.4000 Quinorgo in nominal thicknesses of 3-, 7-, 10- and 15-mils respectively.

No.4000 GR Quinorgo, made with highly purified asbestos fiber by a special wet-felting process, is characterized by the same thermal stability as all Tilton products. When standard Quinorgo is combined with glass cloth, the desirable electrical properties are re-

tained and great physical strength is obtained from the glass cloth.

Quinorgo No.4000 GR is applicable for Motor Repair Shops, Motor and Generator Manufacturers as well as Transformer, Solenoid Equipment and Cable Manufacturers. Primarily it is intended for use when standard Quinorgo is found to lack the required mechanical strength. Specific uses for No.4000 GR include slot liners, phase separators, layer, wrapper and barrier insulation, rotor bar wrapping, inter-coil insulation, motor-coil binding tapes and cable wrapping.

### No.4000 GL Quinorgo

*(Glass Cloth Reinforced—A Class "B" Insulation)*

Quinorgo No.4000 GL is a higher quality asbestos base, Class "B" electrical insulation than No.4000 GR in that it contains two layers of Standard No.4000 Quinorgo and a sheet of glass cloth. In its triplex construction, tightly woven glass cloth is inserted between two layers of Quinorgo and bonded with polyvinyl acetate adhesive.

In the "GL" construction, more pressure is utilized in combining than in "GR" construction, with the result that a denser sheet is produced having greater dielectric strength, for a given nominal thickness. It also affords two smooth exterior surfaces of Quinorgo.

No.4000 GL Quinorgo also lends itself readily to treating and coating with electrical insulating varnishes and resins because of the untreated No.4000 Quinorgo used in its manufacture. In the thinner calipers, No.4000 GL Quinorgo has considerable flexibility, while the heavier sheets are rather rigid. It is supplied in nominal thicknesses of 8.5, 12, 16 and 21 mils. To



make these finished calipers, two sheets each of 3-mil, 5-mil, 7-mil and 10-mil, No.4000 Quinorgo are used.

Primarily, the fields of use for No.4000 GL Quinorgo are the same as No.4000 GR Quinorgo, that is, Motor Repair Shops, Motor and Generator Manufacturers as

well as Transformer, Solenoid Equipment and Cable Manufacturers. Specific uses include slot liners, phase separators, layer, wrapper and barrier insulation, rotor-bar wrapping, inter-coil insulation, motor-coil binding tapes and cable wrapping.

### Available Thicknesses, Forms and Sizes

For Direct Sale to Industrial Users	Small Rolls and Tapes Packaged for Sale Through Electrical Insulation Distributors
<b>Thicknesses:</b> No.4000 GR—7-mil (0.007"), 10-mil (0.010"), 13-mil (0.013"), 16-mil (0.016") No.4000 GL—8.5-mil (0.0085"), 12-mil (0.012"), 16-mil (0.016"), 21-mil (0.021")	<b>Thicknesses:</b> No.4000 GR—7-mil (0.007"), 10-mil (0.010"), 13-mil (0.013") No.4000 GL—8.5-mil (0.0085"), 12-mil (0.012"), 16-mil (0.016")
<b>Forms: Sheets and Rolls*</b> <b>Cut Sheets:</b> Widths of $\frac{1}{2}$ " thru 5", in lengths of 1" to, but not including 10"; over 5" thru 36", in lengths of 10" thru 60" <b>Rolls:</b> Widths— $\frac{1}{2}$ " thru 36", in increments of $\frac{1}{16}$ " Lengths—see table below Outside Diameters—for width $\frac{1}{2}$ " thru $\frac{3}{4}$ ", approx. 8"; for widths over $\frac{3}{4}$ ", approx. 10" thru 14" Cores: $1\frac{1}{2}$ " or 3" ID for rolls less than 36" wide; 3" ID only for 36" wide rolls <b>Tolerances:</b> Width and Length— $\pm\frac{1}{16}$ " per ft or fraction thereof	<b>Rolls:</b> 18" wide; 36, 72 and 144 yards long 36" wide; 144 yards long <b>Cores:</b> 18" width, $1\frac{1}{2}$ " Inside Diameter 36" width, 3" Inside Diameter <b>Tapes:</b> Widths of $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1" Lengths of 36, 72 and 144 yards <b>Cores:</b> $\frac{3}{8}$ " Inside Diameter; Thicker Tapes use $1\frac{1}{2}$ " Inside Diameter and Adaptor to reduce to $\frac{3}{8}$ " <b>Cut Sheets:</b> 36" x 36" <b>Tolerances:</b> Width and Cut Sheet Length, $\pm\frac{1}{16}$ " per foot or fraction thereof Roll Length, -0, +1 yard

\* Sheets, Rolls and Cores in sizes other than shown, on special order.

### Approximate Lengths of Standard Rolls, Yards

No.4000 GR Quinorgo									No.4000 GL Quinorgo							
Width in Inches	7-Mil		10-Mil		13-Mil		16-Mil		8.5-Mil		12-Mil		16-Mil		21-Mil	
	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core	1½" Core	3" Core
¾	188	162	134	113	105	88	84	70	155	130	110	95	84	70	65	61
7⁄8	438	412	308	286	236	221	190	177	361	336	256	239	190	177	145	134
1¼	438	412	308	286	236	221	190	177	361	336	256	239	190	177	145	134
36	—	358	—	220	—	173	—	141	—	222	—	158	—	123	—	97

### Physical and Electrical Properties\*

(All samples conditioned at 70 F, 50% R.H.)

	No.4000 GR Quinorgo				No.4000 GL Quinorgo			
Nominal Thickness, Mils ( $\pm 10\%$ )**	7	10	13	16	8.5	12	16	21
Average Weight, lb per 100 sq ft ( $\pm 15\%$ )	3.1	5.0	6.4	8.3	5.0	7.0	9.0	11.4
Breaking Strength—								
Machine Direction, lb per in. width	100	125	135	150	125	135	145	150
Cross Direction, lb per in. width	80	100	115	125	90	100	115	125
Tear (Machine Direction), grams	600+	800+	800+	800+	600+	800+	800+	800+
Bursting Strength (Mullen), psi	60+	60+	60+	60+	60+	60+	60+	60+
Dielectric Strength, total volts	750	1800	2200	2900	1500	3600	3800	4400
Vol. Resistivity†, megamegohms-inches	0.50	0.50	0.50	0.50	0.35	0.35	0.35	0.35
Dielectric Constant††	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Power Factor††, percent	15	15	15	15	25	25	25	25
Specific Impedance, megohms-inches	2500	2500	2500	2500	1500	1500	1500	1500

\* These are laboratory values given only to indicate approximate properties and are not to be used for specifications.

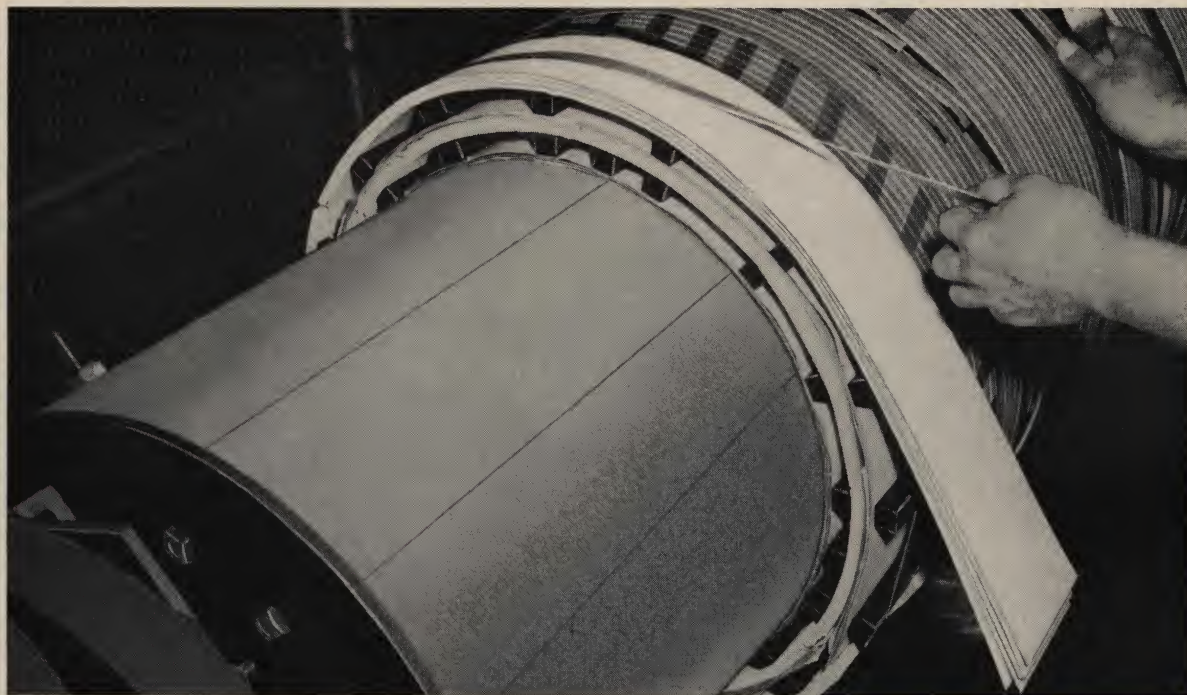
\*\* Caliper measured (rest method) per TAPPI, T-411 or ASTM, D-645, Method A.

† Test method, ASTM D257-46.

†† Test method, ASTM D150-47, Parallel Resistance Substitution Circuit.



## No. 1100 Quinorgobord



*Multiple layers of Quinorgobord form the end packing of this 7500/10,000 KVA Class "B" transformer*

No. 1100 Quinorgobord\* is a quality board-like material for use in the Class "B" (130 C) electrical insulation field. Developed for application where regular Quinorgo is too thin, it consists of purified asbestos fiber (always more than 93 percent) and a polyvinyl acetate binder.

Quinorgobord is not intended to be a finished electrical insulation—rather it is a base sheet with good, inherent thermal characteristics, ready for further processing by the customer. Its extra thickness (up to  $\frac{1}{4}$  inch) makes it ideal when treated for barrier insulation, spacer sticks, winding cores, and similar purposes. Coating with resins or varnishes can be done before application or during the processing of the equipment. Further densification by pressing is also possible.

Quinorgobord, because it is made on a special wet process cylinder machine, has a lower density than Quinorgo. This characteristic tends to lower dielectric strength and other electrical properties initially but these are improved with further treating or processing.

Although Quinorgobord is intended primarily to be a base material for further treating, it can in some cases

be used as is. Some of the "as is" uses are spacing material in transformer construction, winding core for low-temperature resistors and separator discs in lifting magnets. These examples are all predicated on low-voltage stresses and the Quinorgobord absorbing some resin or varnish during processing of the equipment. Quinorgobord, particularly in the thinner grades, has good flexibility and handling qualities, but the material, characteristically, has low specific impedance.

No. 1100 Quinorgobord is available  $\frac{1}{32}$ ,  $\frac{1}{16}$ ,  $\frac{1}{8}$ ,  $\frac{3}{16}$  and  $\frac{1}{4}$  inches thick in standard sheets 48 x 48 inches or 48 x 42 inches and cut pieces.

### Sizes and Tolerances

Standard Sheet Sizes . . . . .	42" x 48", 48" x 48"
Tolerances, Length and Width . . . . .	$\pm \frac{1}{8}$ "

Cut Pieces: Square or rectangular shaped pieces, neither dimension less than 6"
Tolerances (Cut pieces): $\frac{1}{32}$ ", $\frac{1}{16}$ " and $\frac{1}{8}$ " thick = $\pm \frac{1}{16}$ "
$\frac{3}{16}$ " and $\frac{1}{4}$ " thick = $\pm \frac{3}{32}$ "

Other Sizes, Shapes and Tolerances on special inquiry.

The average physical and electrical characteristics for No. 1100 Quinorgobord are given in the table on the reverse of this sheet.

\* Reg. U. S. Pat. Off.

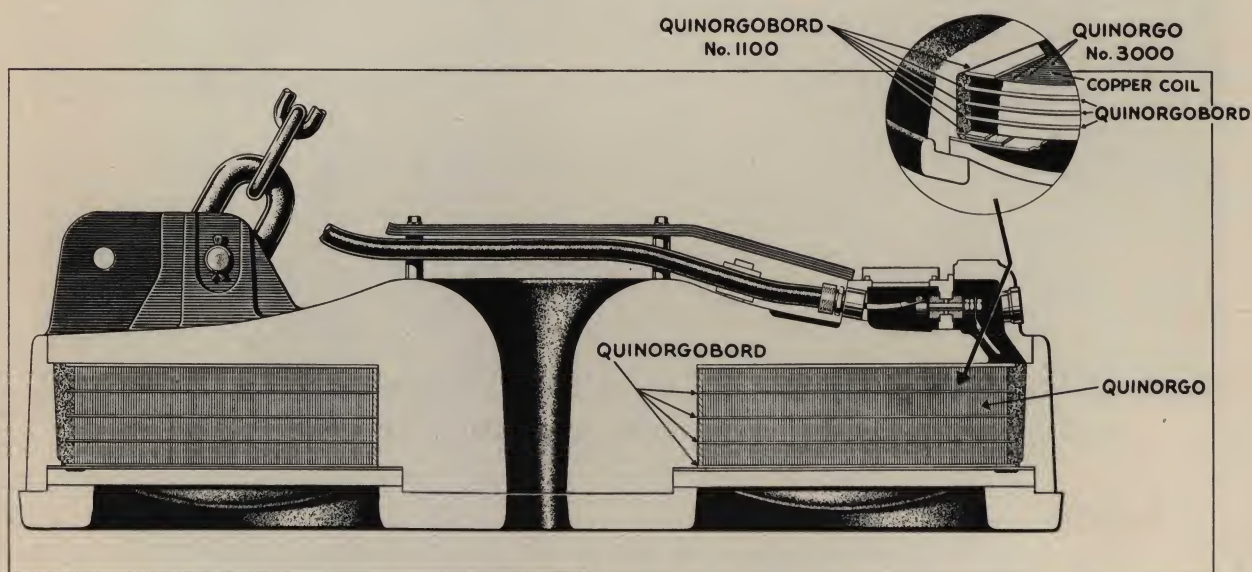


*Approximate Average Physical and Electrical Characteristics\**

Thickness, inches ( $\pm 15\%$ ) . . . . .	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$
Average Weight, lb per sq ft ( $\pm 15\%$ ) . . . . .	0.14	0.30	0.55	0.87	1.16
Breaking Strength, lb per inch width . . . . .	40	45	60	80	100
Bursting Strength (Mullen), psi . . . . .	70	90	—	—	—
Dielectric Breakdown, total volts . . . . .	5000	6500	7000	7250	7500
Dielectric Constant** . . . . .	25	40	50	60	70
Power Factor**, percent . . . . .	60	60	60	60	60
Specific Impedance, megohms-inches . . . . .	400	300	200	150	100

\* Samples conditioned at 70 F, 50% R.H. These are laboratory values given only to indicate approximate properties and are not to be used for specification.

\*\* A.S.T.M. D 150-47 Parallel Resistance Substitution Circuit.



*Quinorgobord No. 1100 is used for sealing disks or insulating disks in this "lifting magnet." A companion Johns-Manville product, Quinorgo No. 3000, serves as strap insulation. This combination overcomes the loss of lifting ability or grounds due to short circuits*



## Types 1 and 3 Quinterrabord

Quinterrabord, a board-like variation of Quinterra®, is composed of 100 percent highly purified asbestos in the base sheet. It retains all the pyrolysis resistance and thermal stability of basic Quinterra. Quinterrabord is available in two forms: Type 1 the base sheet untreated; and Type 3, the base sheet treated with silicone resin and air-dried.

### Type 1 Quinterrabord (Untreated)

Untreated Type 1 Quinterrabord is a superior-base material for processing into thermally stable Class "B" and Class "H" electrical insulations. Developed for application where greater separation is required than Quinterra provides, it is composed entirely of the same highly purified asbestos fibers as Type 1 Quinterra. Type 1 Quinterrabord is produced without the addition of any binder or sizing on a special wet-process cylinder machine, thus giving it greater thickness (up to 1/4") but lower density than Type 1 Quinterra. It is soft and absorbent, yet has sufficient mechanical strength for normal handling and treating. This thermally stable asbestos spacer affords an excellent carrier for treatment with a wide variety of electrical insulating resins and varnishes.

Pyrolysis resistant, completely inorganic Type 1 Quinterrabord is not intended to be a finished electrical insulation—rather it is a base sheet ready for further processing into high quality electrical insulations. Because of lower density, Type 1 Quinterrabord has slightly lower dielectric strength and other electrical properties than Type 1 Quinterra. These values, of course, improve when the density is increased by treating or pressing.

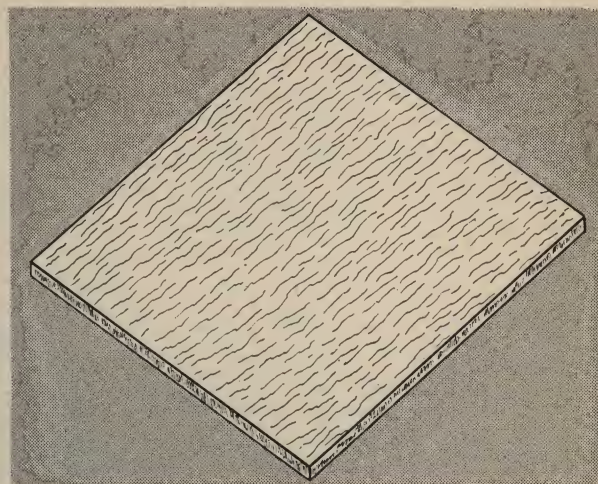
Type 1 Quinterrabord is available in standard sheets 48" x 48" or 48" x 42" and in cut pieces. Available thicknesses are 1/32", 1/16", 1/8", 3/16" and 1/4".

#### Physical and Electrical Properties\* for Type 1 Quinterrabord (Untreated)

Nominal Thickness, inches (±15%)	1/32	1/16	1/8	3/16	1/4
Avg wt, lb per sq ft (±15%)	0.16	0.31	0.63	0.94	1.25
Breaking Strength, lb per in. width	5	13	50	75	90
Bursting Strength (Mullen), psi	20	40	50	—	—
Dielectric Strength, total volts	4500	4750	5500	6000	6500
Dielectric Constant†	40	55	70	80	85
Power Factor†, percent	85	85	85	85	85
Specific Impedance, megohms-inches	175	125	95	80	75

\* These are laboratory values given only to indicate approximate properties and are not to be used for specifications.

† ASTM D150-47 Parallel Resistance Substitution Circuit.



Quinterrabord affords the pyrolysis resistance of thin basic Quinterra in sheets up to 1/4" thick

### Type 3 Quinterrabord (Silicone Treated)

Type 3 Quinterrabord is basic Type 1 Quinterrabord treated with silicone resin (Dow Corning, DC-2104) to a resin content ranging from about 20 to 35 percent. Its shelf life is known to exceed one year. As supplied by Johns-Manville, it is air-dried to a tack-free state, but not cured, so remains somewhat flexible.

Because it contains uncured silicone resin, Type 3 can be processed by oven-curing, laminating, heat forming, hot-press curing, and densifying. These processes result in cured or uncured products as desired. Suitable curing normally requires 30 minutes at 250 C or eight hours at 200 C. For forming without curing, temperatures of 100 to 160 C are recommended to soften the resin. For laminating and densifying, pressures in the range of 1000 psi are required. Tests indicate that the best pressed product is formed by hot-pressing at 1000 psi and 250 C for 30 minutes, but a somewhat similar product results from pressing at 160 C and then oven curing at either of the above time-temperature cycles.

Saturating the Type 1 Quinterrabord results in a thermally stable, pyrolysis resistant material which, like Quinterra, will act as a dielectric even though extreme temperatures destroy the saturant. The unusual bonding action between the high temperature silicone resin and the purified asbestos fibers assures trouble-free service at temperatures as high as 250 C. Class "H" insulation only requires stability at 180 C.



To show the potential as well as the "as is" physical and electrical properties of Type 3 Quinterrabord, tests were made on three different forms: air-dried and uncured (as J-M supplies the material), oven-cured and press-cured. Oven-curing consisted of heating the air-dried sheet in a forced convection oven at 200 C for eight hours, while press-curing was accomplished by hot-pressing the air-dried sheet at 250 C and 1000 psi for 30 minutes. The results on all five standard thicknesses are summarized in the table of "typical average physical and electrical properties" following. These are, of course, approximate values based on limited laboratory experiments and not for specification. Users

may, however, expect to get similar values from comparable efforts.

In these tests, compressibility averaged 20 to 30 percent for the air-dried sheets, less than five percent for oven-cured sheets and less than one percent for the press-cured sheets. When initially heated to 200 C, air-dried samples became very soft then slowly hardened while cured samples were effected to a negligible degree.

Type 3 Quinterrabord is supplied in standard sheets 48" x 48" or standard full sheet cut into rectangular shapes according to specification. Five thicknesses are available:  $\frac{1}{32}$ ",  $\frac{1}{16}$ ",  $\frac{1}{8}$ ",  $\frac{3}{16}$ " and  $\frac{1}{4}$ ".

**Physical and Electrical Properties for Type 3 Quinterrabord (Silicone Treated)**

(These are laboratory values given only to indicate approximate properties and are not to be used for specifications)

Nominal Thickness, inches ( $\pm 15\%$ ) .	1/32			1/16			1/8			3/16			1/4		
Condition of Material . . . . .	Air-Dried Only	Oven-Cured *	Press-Cured **	Air-Dried Only	Oven-Cured *	Press-Cured **	Air-Dried Only	Oven-Cured *	Press-Cured **	Air-Dried Only	Oven-Cured *	Press-Cured **	Air-Dried Only	Oven-Cured *	Press-Cured **
Actual Thickness, inches ( $\pm 15\%$ ) . .	0.033	0.033	0.024	0.064	0.064	0.048	0.127	0.127	0.096	0.189	0.189	0.142	0.252	0.252	0.189
Avg Wt, lb per sq ft ( $\pm 15\%$ ) . . .	0.22	0.21	0.21	0.43	0.42	0.42	0.86	0.84	0.84	1.28	1.26	1.26	1.67	1.65	1.65
Breaking Strength, lb per in. width .	102	152	214	115	179	288	127	185	384	129	195	426	131	202	510
Rockwell Hardness (M) . . . . .	—	—	30	—	—	30	—	—	32	—	—	30	—	—	30
Water Absorption, percent, 24 hr . .	2.8	1.6	0.9	2.4	1.4	0.8	2.1	1.2	0.4	1.6	1.3	0.5	1.2	0.7	0.3
Dielectric Strength, total volts . . .	7700	8000	11600	8640	9280	13400	9200	10000	14500	9830	10770	15500	10400	11400	16500
Dielectric Constant† . . . . .	30	20	19	59	30	29	125	50	49	190	70	68	250	85	83
Power Factor†, percent . . . . .	40	38	34	43	40	35	48	43	37	53	47	42	56	50	46
Specific Impedance, megohms-inches .	250	400	440	180	330	360	67	200	222	53	149	165	42	125	140
Arc Resistance (ASTM D495), seconds	250	250	350	250	250	350	250	250	350	250	250	350	250	250	350

\* Oven-cured: Heated in forced convection oven for eight hours at 200 C.

\*\* Press-cured: Hot-pressed for 30 minutes at 250 C and 1000 psi.

† ASTM D150-47 Parallel Resistance Substitution Circuit.











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### Filter-Aids and Mineral Filters

#### *Celite Filter-Aids:*

General description and application . . . . . FI-1 to 5

#### *Celite Mineral Fillers:*

General description and application . . . . . FI-500 to 504

*(For complete list of data sheets, see other side of this page)*

#### Asbestos Fibre and Cloth

Asbestos fibre and cloth of various types are also used in filtering processes, particularly in the filtration of chemicals. These materials are described in the "Textiles and Fibres" (TX) section.



## Filter-Aids and Mineral Fillers

*Complete Index of Data Sheets Available*

### *Celite Filter-Aids:*

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Filter-Cel Laboratory Standard . . . . .	FI-7
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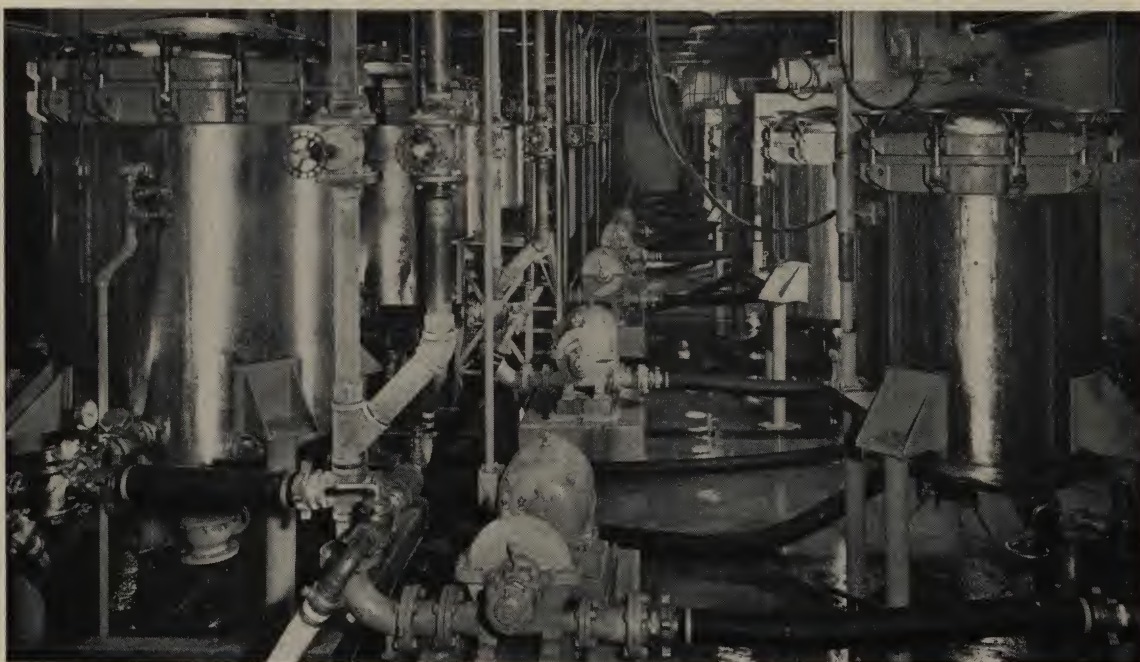
### *Celite Mineral Fillers:*

Celite No. 165-S as a flatting agent for varnishes, lacquers and enamels . . . . .	FI-510 to 512
Celite No. 209 as an extender for insecticides . . . . .	FI-530 and 531
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## Celite Filter Aids



*Celite filter aids keep this battery of beer filters operating at top efficiency*

**F**ILTRATION is usually accomplished by forcing a liquid, under pressure, through a cloth or screen. Theoretically, the liquid should pass through the openings of the filter cloth and the impurities should remain upon the cloth. But what actually happens in many cases is that the finer suspended solids pass with the liquid through the comparatively coarse openings in the ordinary filter cloth; the larger particles remain behind upon the cloth to clog the openings, smear the cloth, and slow down or entirely stop the flow through the filter press.

Such difficulties are particularly emphasized in what may be termed "clarification filtrations," where the particles to be removed are non-rigid, slimy, or colloidal in size. Oils, sugar syrups, glucose and cereal beverages are among the many products which present this type of filtration problem. The gelatinous, finely divided suspended matter cannot be completely removed, nor can even indifferent clarification be effected economically unless a filter aid is added before the liquid passes through the press.

A small quantity of the appropriate Celite\* filter aid assures the formation of an open, porous cake on the cloth. This cake traps all suspended matter, greatly

increases the rate of flow and reduces operating costs, as well as enhancing the filtrate clarity. The use of filter aid further assures easy and quick cake removal without injury to the cloth.

Johns-Manville furnishes nine standard grades of Celite\* filter aids which are listed below in order of their relative rate of flow, starting with the lowest:

- |                       |                     |               |
|-----------------------|---------------------|---------------|
| 1. Filter-Cel*        | 4. Celite 512       | 7. Celite 503 |
| 2. Celite 505         | 5. Hyflo* Super-Cel | 8. Celite 535 |
| 3. Standard Super-Cel | 6. Celite 501       | 9. Celite 545 |

Celite filter aids are finely divided, porous, light in weight, inert and do not affect the chemical or physical characteristics of the filtrate. They are milled from exceptionally pure diatomaceous silica (Celite), the individual particles being microscopic in size. Because of low specific gravity, they may be readily made to remain in suspension during the filtration process, which is necessary in order to assure clear, brilliant filtrates and long filtering cycles.

Which of these filter aids should be used for a particular filtration depends on the specific properties of the suspended matter to be removed and on the viscosity of the liquid. One of them accommodates practically every case. The selection of the proper grade is discussed on subsequent pages.

\* Reg. U. S. Pat. Off.



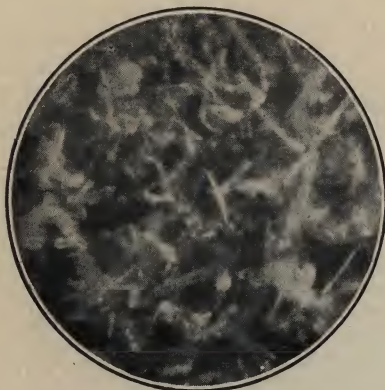


Fig. 1. Press cake of Filter-Cel.  
Magnification 200x

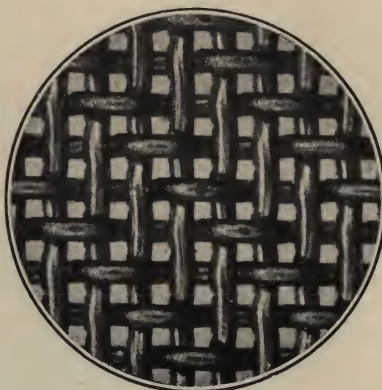


Fig. 2. Metal filter screen, 60 x 60 mesh.  
Magnification 13x

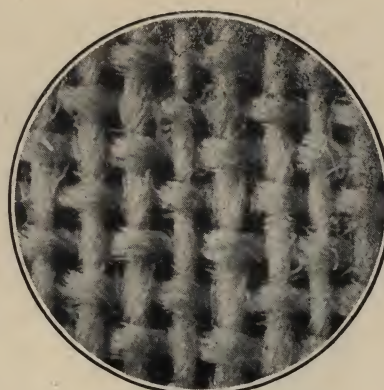


Fig. 3. Close-texture filter cloth.  
Magnification 20x

*Fig. 1 shows a section of a press cake of filter aid under the microscope. The pore channels through a mat of the filter aid, just visible even at high magnification, are much smaller than the finest particles of any suspended precipitate. In comparison, the metal filter screen and closely-woven filter cloth, shown in Figures 2 and 3, are "open sieves" which can retain only the coarse solid particles occurring in the liquids being filtered*

### How Celite Filter Aids Are Used:

A small quantity of the proper Celite filter aid is added to the liquid to be filtered. This quantity ordinarily varies from  $\frac{1}{10}$  to  $\frac{1}{2}$  of 1 percent of the weight of the liquid, depending upon the nature and amount of the suspended matter present.

After the filter aid is well stirred into the liquid the mixture is passed through the filter where the filter aid and the impurities are retained as a porous film or cake against the filter cloth, allowing the clear liquid to run through.

Celite filter aids are used with all types of pressure filters. The best results on a manufacturing scale are obtained with pressure filters of the type having space for the accumulation of the impurities in the form of a filter cake, such as plate and frame, leaf type, and vacuum filters. Filter aids must always be used with a retaining medium such as cotton or woolen cloths, fine metal screens, wire cloths, etc. The filter aid, with the suspended impurities, forms a porous cake which can be cleanly and completely parted from the filter cloth.

### Selection of the Proper Filter Aid:

The nine Celite filter aids are produced by patented processes to build up filter cakes of different porosities. Celite 545 causes the formation of a filter cake having the largest pores and Filter-Cel one with the smallest pores. Intermediate grades fall between these two filter aids. The actual difference in pore size is microscopic but has a very important bearing on clarity and rate of flow.

For instance, considerably higher rates of flow are obtained through Hyflo Super-Cel than through Standard Super-Cel and considerably higher rates of flow through Standard Super-Cel than through Filter-Cel.

Because of the nine different cake porosities, a filter aid can be chosen which will give maximum rate of flow and the required clarification. In practice, the coarsest filter aid yielding a filtrate of satisfactory clarity is the one to use as the best flow possible is then obtained. Should clarity with any filter aid be unsatisfactory, the next finer filter aid should be tried. Filter-Cel (smallest size pore spaces) removes slimy or colloidal type material of less than 0.1 micron in size (1 micron is  $\frac{39}{1,000,000}$  of an inch). In most cases, however, Hyflo Super-Cel will completely screen the fine solid matter out of suspension and is generally used because of its high flow rate.



*A modern experimental filter in the J-M laboratories*



For the usual filtrations the grade of filter aid necessary is now well known. While there are often exceptions the partial list following shows the usual Celite filter aids which should be employed for various types of "clarification" filtrations. However, where raw products may vary 1000 percent in filterability, it is evident that no one filter aid of any selected flow rate will always give 100 percent economical results.

### **Celite 503, 535 and 545**

Adhesives	Oils (heavy)
Casein	Sizings (textile)
Cellulose Esters	Synthetic Resins
Cider (dull finish)	Syrups
Cider (fresh)	Tars
Dextrin	Varnishes (cold cut)
Glue (lower grades)	Varnishes (heavy)
Greases (heavy)	Vegetable Extracts
Gums	Waxes

### **Hyflo Super-Cel and Celite 501**

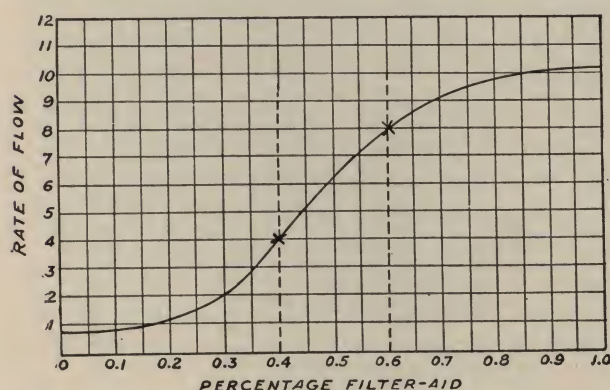
Animal Fats and Oils	Molasses
Beer (pre-filtration)	Pectin (citrus)
Chemical Products	Petroleums (Crude and Refinery Oils)
Dry Cleaners' Solvents	Pyroxylin Bases
Dyestuffs	Shellac
Fish Oils	Silver Recovery
Fruit Juices (very pulpy)	Soap Lye
Glucose	Sorghum
Grape Juice	Sugar Syrups (beet)
Lacquers	Sugar Syrups (tropical)
Liquid Soap (light)	Sulfur
Liquid Soap (heavy)	Varnish (light)
Maltose	Vegetable Oils
Maple Syrup	Wine (tank settlings)
Metallurgical Solutions	

### **Standard Super-Cel and Celite 512**

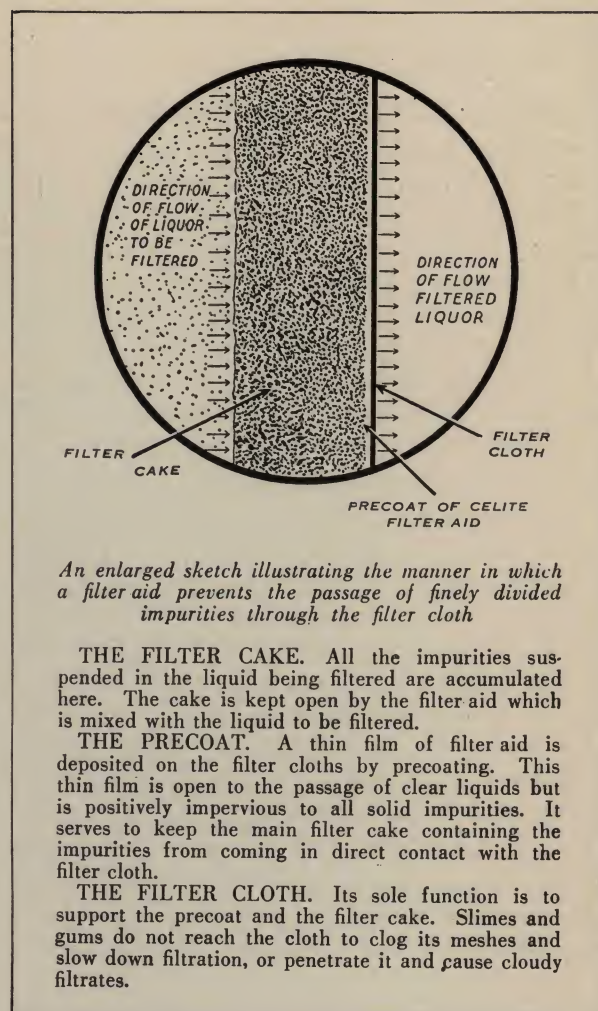
Alcoholic Extracts (vanilla, etc.)	Organic Chemicals
Beer	Pectin (apple)
Cider (high polish)	Pharmaceuticals
Extracts	Sugar (refinery liquors)
Fruit Juices (generally)	Sugar Syrups (refinery)
Gelatine (lower grades)	Water Treatment
Gelatine (higher grades)	Wine (generally)
Glue (higher grades)	Yeast Feeds

### **Filter-Cel**

Lard (wet and dry rendered)	Vinegar
Milk Sugar	Any filtration to remove Ultra-
Precious Metal Filtrations	Microscopic Material



*Rates of flow of same solution with different amounts of filter aid*



*An enlarged sketch illustrating the manner in which a filter aid prevents the passage of finely divided impurities through the filter cloth*

**THE FILTER CAKE.** All the impurities suspended in the liquid being filtered are accumulated here. The cake is kept open by the filter aid which is mixed with the liquid to be filtered.

**THE PRECOAT.** A thin film of filter aid is deposited on the filter cloths by precoating. This thin film is open to the passage of clear liquids but is positively impervious to all solid impurities. It serves to keep the main filter cake containing the impurities from coming in direct contact with the filter cloth.

**THE FILTER CLOTH.** Its sole function is to support the precoat and the filter cake. Slimes and gums do not reach the cloth to clog its meshes and slow down filtration, or penetrate it and cause cloudy filtrates.

*Diagrammatic cross-section through a filter cake*

### **Quantity of Filter Aid Necessary:**

The proper quantity of filter aid depends upon the nature, as well as upon the quantity, of suspended impurities. Sufficient filter aid must be used to obtain the required degree of clarification and a reasonable rate of flow. This amount usually involves having enough filter aid present to envelop and surround completely the suspended substances. In this way a filter cake of the required porosity is obtained. The percentage of filter aid necessary to provide for perfect clarification, protection of the cloths, proper cake formation, etc., is generally from  $\frac{1}{10}$  to  $\frac{1}{2}$  of 1 percent of the weight of the liquid.

The capacity of a press and the length of the filtering cycle can be increased by using a higher percentage of filter aid. As the actual filtering area of filtering equipment in a plant is fixed and limited, varying the



amount of the filter aid provides an economical method for making the capacity of the plant elastic.

### *Filtration Procedure Using Celite Filter Aids:*

A typical filtration system is shown in the following drawing. An initial charge of water, solvent or previously filtered clear liquid containing a suspension of filter aid is mixed in the precoat tank. (Unfiltered or "raw" liquid may be used in precoat but it is not so desirable). Usually from 5 to 10 lb of filter aid per 100 sq ft of filter area are used for this precoat charge, the exact quantity depending on the cloth-smearing tendency of the precipitate. The volume of the initial charge must be from 125 to 150 percent of the volumetric capacity of the press, pump and pipe lines.

While preparing the precoat, a predetermined quantity of filter aid is added to the main batch of liquid in the mixing tank, which should be equipped with a paddle or other means of continuous agitation to assure keeping the filter aid uniformly dispersed in the liquid. This tank is usually equipped with a pump capable of putting through the batch in a definite time cycle, at pressures up to 60 psi. When a separate pump is used for the precoat, as in large installations, it is usually a low-pressure centrifugal pump.

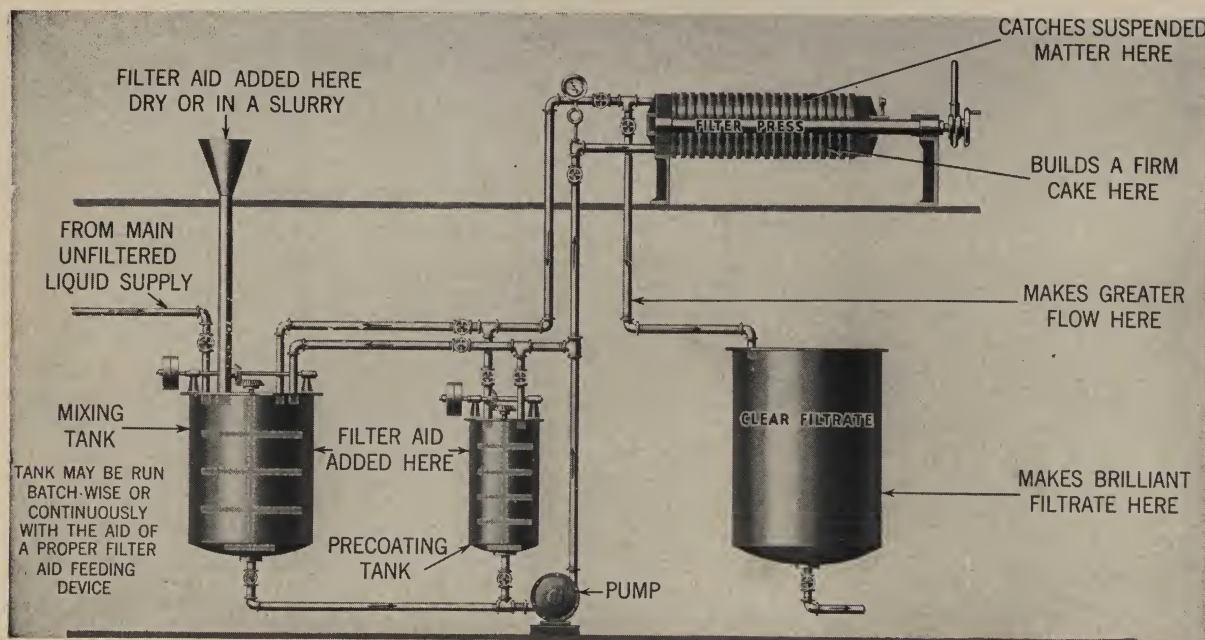
The precoat suspension is then pumped through the press at a low pressure (below 10 psi), depositing the filter aid in a thin film over the entire surface of the filter cloth. To assure a uniform precoat layer, the

pump should be large enough, as a rule, to force liquid through the press at the rate of 10 to 20 gal per sq ft per hour. Regardless of what liquid is used for the precoat suspension, the liquid, after flowing through the press, is usually circulated back to the precoat tank until it runs absolutely clear.

Where the liquid used to suspend the filter aid for precoat is the same as the liquid in the main charge to be filtered, the flow from the filter is turned to the clear liquid receiving tank as soon as clarity of filtrates is obtained. Just before the precoat tank is empty, the draw-off valve on the mixing tank is opened and the outlet valve on the precoat tank is closed. Thus a continuous flow to the filter is obtained. The precoat tank should not be allowed to empty before the main charge is admitted to the press or there will be a period when there is no pressure upon the precoat film and it may slide from the cloth.

When the precoat filter aid is suspended in water, the water is run to waste. Otherwise the procedure is as above. However, should dilution be undesirable, air pressure can be applied to the filter and the precoat tank outlet valve closed just before the precoat tank is empty. This air pressure will blow the excess water out of the filter. The main charge of liquid is then admitted to the press and the air line closed.

At the end of a cycle, when the cake space of the press has been filled or the rate of flow has dropped to a minimum, the press is stopped and made ready for



*Layout of a filter station using Celite filter aids, showing typical filtration system*

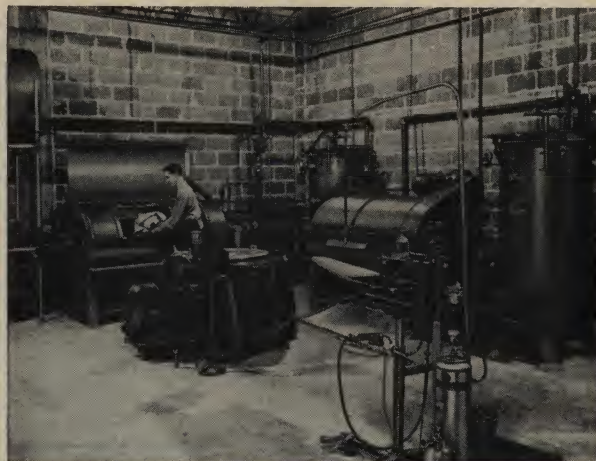


another cycle. The impurities which have been trapped are securely held in the filter aid cake. The capillary channels of the filter cake are filled with the liquid filtered. By pumping hot or cold water, or some other solvent to suit the conditions, through the cake, the liquid can be displaced and removed. It is usually necessary to pump the wash liquid into the filter cake at about 10 lb higher pressure than the final filtering pump pressure. The press is then opened and the cake drops cleanly from the cloth.

### *Function of the Filter Aid:*

In clarification filtration, the suspended solids are usually of such a nature that if sufficient filter aid is not used, the cloths of the press become slimed, stiff, and impervious. The cloths then have to be removed and laundered or replaced at the end of each filtering cycle; the press is out of commission in the meanwhile, and the capacity of the filter station is greatly reduced. With the use of the filter aid, long filtration cycles are assured and the filter cloth remains open and porous.

While the function of the precoat is to protect the cloths and assure a brilliant filtrate at the beginning of the operation, the addition of  $\frac{1}{10}$  to  $\frac{1}{2}$  of 1 percent filter aid to the entire batch is also necessary to secure good results through the run. The filter aid in the main



*Hyflo Super-Cel assures a continuous supply of clean solvent in this dry-cleaning plant*

batch prevents the sliming of the filter aid precoat and continues to build up an open porous cake which allows the filtration to proceed. The pores of the precoat are otherwise quickly clogged by the slimes in the main batch liquid so that the flow of the press is choked.

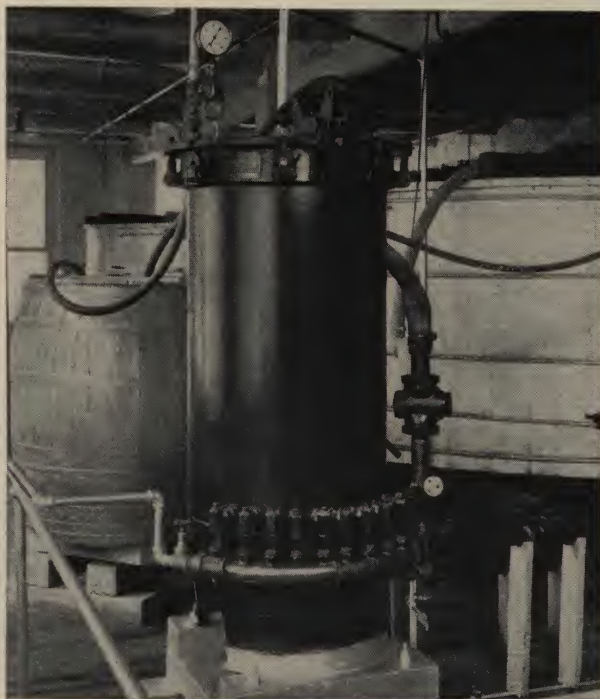
While precoating is not always considered necessary, the heavily charged precoat liquid first entering the press gives the cloths the same positive protection that a large excess of filter aid in the main body of the liquid would afford, and assures the same brilliance of filtrate toward the end of the cycle when the higher pressures are being used. Precoating is practically always done on large scale work where continuous operation of the filter presses is an absolute necessity.

On leaf-type filters particularly, precoating is employed due to the fact that the cloths are sewed on the frames and cannot be removed and cleaned without considerable difficulty. Other types of leaf filters are provided with metal cloths which are soldered to the leaf frames. Keeping the cloths clean on this type of press is essential for continuous operation.

In many ordinary filtrations when enough filter aid is added, the cake is so porous and breaks from the cloth so cleanly that the precoat is unnecessary. Such conditions are usually found in plate and frame installations on certain products but the filter cloths are removed frequently (sometimes at the end of each cycle) and washed before the next run to prevent cloths hardening, fermentation and mold growth.

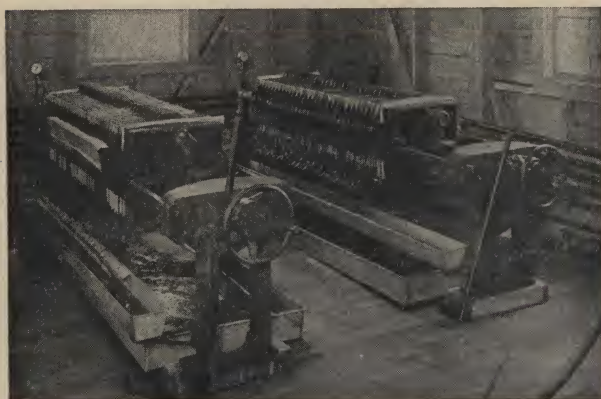
### *Rates of Flow:*

The capacity of a pressure filter is usually expressed as so many gallons (or fraction of a gallon) per sq ft of filter area per hour on the total cycle, which includes



*This pressure leaf filter, in conjunction with Filter-Cel, is effectively employed for the clarification of high-grade vinegar*





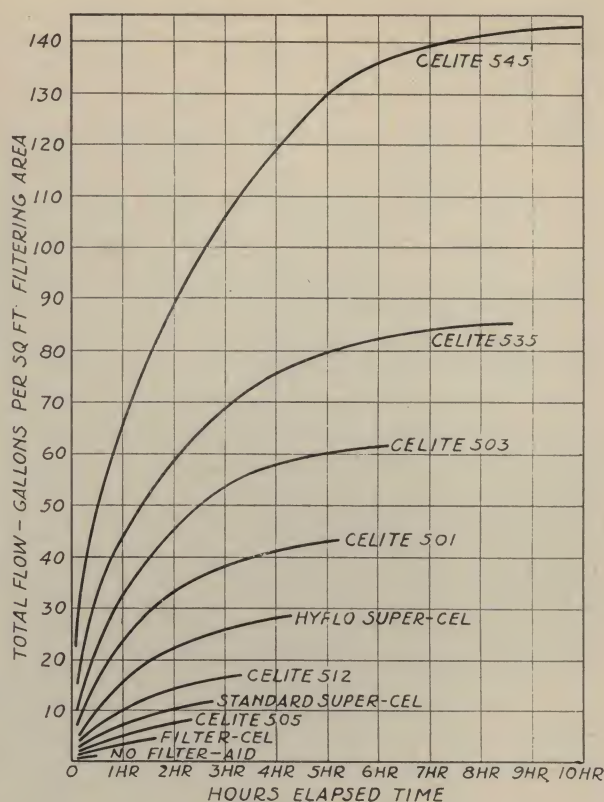
*The use of a Celite filter aid in these filter presses results in a crystal clear maple syrup*

the "dead" time on the press (cleaning, filling, washing, etc.). Rates of flow in "clarification filtrations" depend upon: Filter area; amount of filter aid and type of filter aid used; length of filter cycle; pump pressure; treatment, concentration, viscosity and temperature of liquid; nature and amount of suspended matter to be removed; and idle time on filter.

The various Celite filter aids are now so universally used that the rate of filtration of practically every liquid in important processes is known. For example, dense viscous liquids such as sugar syrups, varnishes, etc., are filtered with Celite filter aids with press capacities of 2 to 10 gal per sq ft per hour. With free filtering, non-viscous liquids such as vinegar, cereal beverages, etc., capacities of 20 or more gal per sq ft per hour can be obtained.

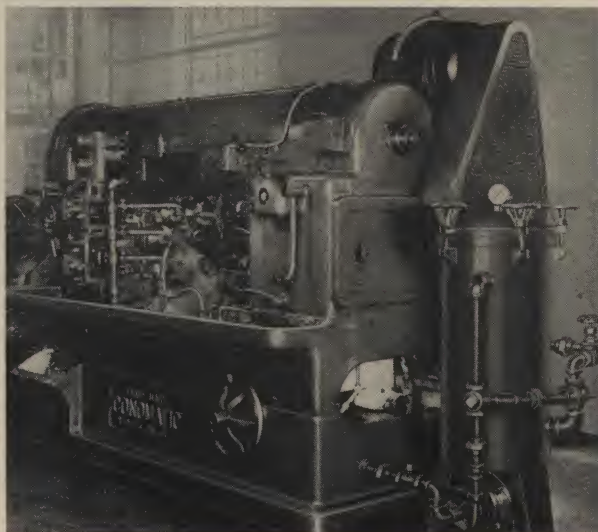
When a filter press is started on a new cycle, the rate of flow declines sooner or later to a point beyond which it is not economical to continue operation. The press is then opened up and cleaned in preparation for another cycle. With increased pump pressure no marked falling off in the rate of flow over an extended period of time would be exhibited by a liquid with an absolutely free-filtering precipitate. In actual practice, however, the liquids which must be filtered exhibit a falling off in rate of flow as filtration proceeds and as the filter cake builds up in thickness and resistance. The rate of decline in flow depends on the nature of the liquid and the amount and nature of the solids which are present.

The purpose of using Celite filter aids is to make slow-filtering precipitates (or other solids to be removed) act more like free-filtering precipitates in the filter press, in addition to assuring the highest possible clarity of finished filtrates. It has been found in many



*Relative rates of flow and filtering capacities obtained with Celite filter aids, and no filter aid, in filtering a certain syrup; quantities of the filter aids being the same*

cases that a slight increase in the percentage of filter aid added, not only increases the rate of flow but also makes longer filtration cycles possible. The result in



*Celite filtration keeps cutting oils free of solids for precision machine tool work*



such cases is that the cost of filtration is decreased because of the increase in output per unit of time, labor and equipment.

### *Filter Cloths:*

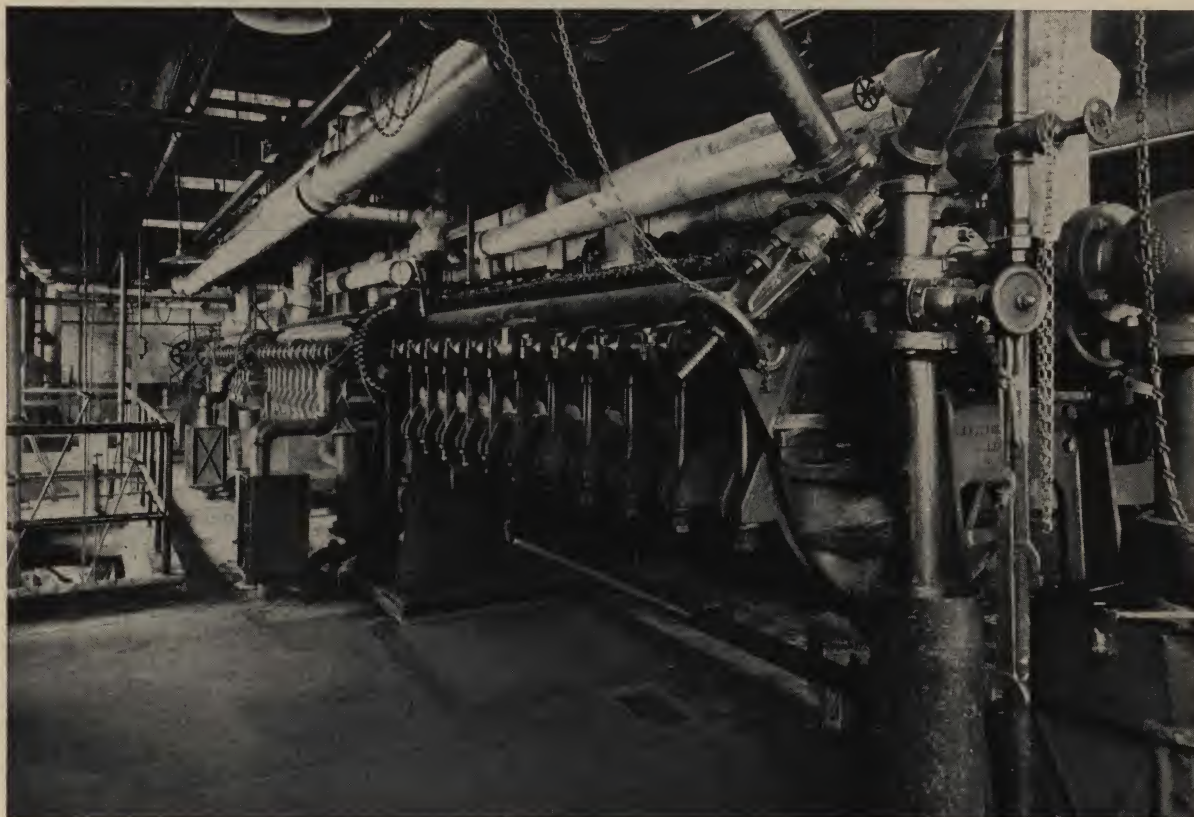
Due to the fact that one result of using a filter aid is to transfer the true filtering surface from the face of the cloth to the filter aid, special and expensive weaves and heavy weight filter cloths are not necessary. In leaf filters a light drill cotton cloth is satisfactory as there is no wear upon the cloth. In the smaller sized plate filters, up to and including 24 inches, an open weave 10-oz duck is satisfactory. In still larger plate filters, 12-oz and 14-oz ducks are recommended due to the harder service expected from the cloths. Also, in the case of the larger plate filters, 36 inches and greater, where the wear upon the cloths is excessive or the labor unskilled, a double layer of cloth is desirable. Next to the plate is laid a 14 or 16-oz burlap. Over this is laid a 12 or 14-oz duck. The burlap is used to prevent cutting the duck when tightening up the filter. The burlap also helps to keep the lighter cloth from being

forced so tightly against the filter surface as to prevent proper drainage of the filtered liquid to the outlet channels. Only the duck requires laundering at intervals as the duck protects the coarse burlap beneath.

Cleaning any filter cloth by brushing or scraping should be avoided as this tends to force the cake into the pores of the cloth and choke it. The best method of cleaning cloths is to launder them in a tumbler type of washer, if hosing the cloths while still in place proves to be unsatisfactory.

Wire screens and metals cloths are finding increased fields in many of the chemical industries. The ability of Celite filter aids as a precoat to protect such cloths widens the field greatly for this type of fabric. On leaf-type rotary pressure filters, the leaves are usually covered with metal cloth, in spite of its higher cost per square foot, on account of the very great cost of dressing the filter. It is particularly essential to protect the more expensive metal cloth on such filters with a Celite filter aid film to assure continued life of the metal cloth.

A 60 x 60 twilled wire cloth (more than 0.01" wire) is the coarsest weave recommended for use with Celite



*Sweetland filters at the plant of a large sugar refinery. Celite filter aids are used in the various syrups to obtain the highest filtration efficiency*



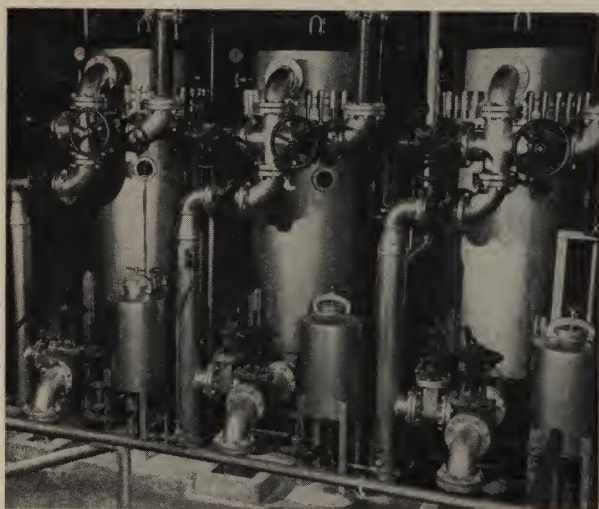
filter aids, and will retain any of the Celite filter aids satisfactorily. The 80 x 70 twilled (0.007" wire) or the 60 x 60 twilled (0.011" wire) will often prove more satisfactory and 24 x 110, 20 x 150, 30 x 150 and 16 x 200 are also used successfully. These metal cloths can now be obtained in monel metal, brass, bronze, steel, etc.

### *Pumps and Pump Operation:*

Ordinarily a centrifugal pump gives best results. There are no pulsations to pack the filter cake and so tend to close the flow channels through it. However, due to the churning action in the pump, some soft suspended particles may be broken into many smaller ones and so cause a liquid to be more difficult to filter.

Other types of pumps which are often used are the diaphragm pump, the triplex belt-driven plunger pump or the regular steam-driven duplex reciprocating pump with ball valves on the water end. A pump of this type should be large enough so that it can be run slowly to avoid pulsation. An air chamber of generous proportions properly installed in the pipe line between the pump and the filter press is absolutely necessary for best results with plunger pumps.

Regardless of the type of pump used it is advisable to start the filtration at a low pressure and either allow this to increase by itself as the cake builds up, or regulate it so that the maximum pressure is not reached much before the end of the filter cycle. This procedure produces a filter cake of more open texture and usually gives a larger output from the filter than would be obtained were full pressure exerted at the start.



*These new vertical filters with cylindrical elements require Celite to produce sparkling clear process water*



*Large quantities of Celite filter aids are used on continuous vacuum precoat filters in the production of antibiotics*

### *Proper Agitation:*

A most important factor in securing best results with Super-Cel and Fifter-Cel is to make sure that they are completely and intimately mixed with the liquid and the mixture kept agitated the entire time filtration is in progress. The importance of thorough and continuous agitation cannot be over-emphasized.

### *Methods of Adding Filter Aid:*

With good agitation in the press feed tank and with adequate time allowed for mixing the filter aid and the liquid, good results are secured when the material is added dry.

To be assured definitely that the filter aid will be mixed intimately with the liquid, the filter aid should be mixed with water, solvent, or clean liquid and added to the liquid to be filtered in the form of a cream suspension or slurry.

Full information on various methods of adding filter aids is given in special data sheets.

### *Advantages of Celite Filter Aids*

**Clarity:** Filtration with Celite filter aids gives a complete and positive separation of solid and liquid. The filtrates obtained are clear, brilliant, and free from all suspended matter.

**Increased Capacity:** Filtration with Celite filter aids greatly increases the capacity of filters, due to



the formation on the cloth of a highly porous cake instead of a slime. Without Celite filter aids many "clarification filtrations" could not be accomplished.

**Longer Cycles:** Less labor is required to operate because of the greater capacity and longer cycles.

**Reduced Operating Costs:** The Celite filter aids make possible the employment of labor-saving types of filters for the clarification of viscous and slow filtering products that otherwise could not be filtered. The wear and tear on filter cloths is greatly reduced due to the readiness with which press cakes containing Celite filter aids are separated from the cloths and due to the less frequent filter cleanings necessary. The cloths are usually ready for the next cycle without further cleaning; costs for laundering and replacement of cloth are therefore reduced to a minimum. Thinner and less expensive grades of cloth are used with Celite filter aids, giving results superior to those obtained with a heavier cloth.

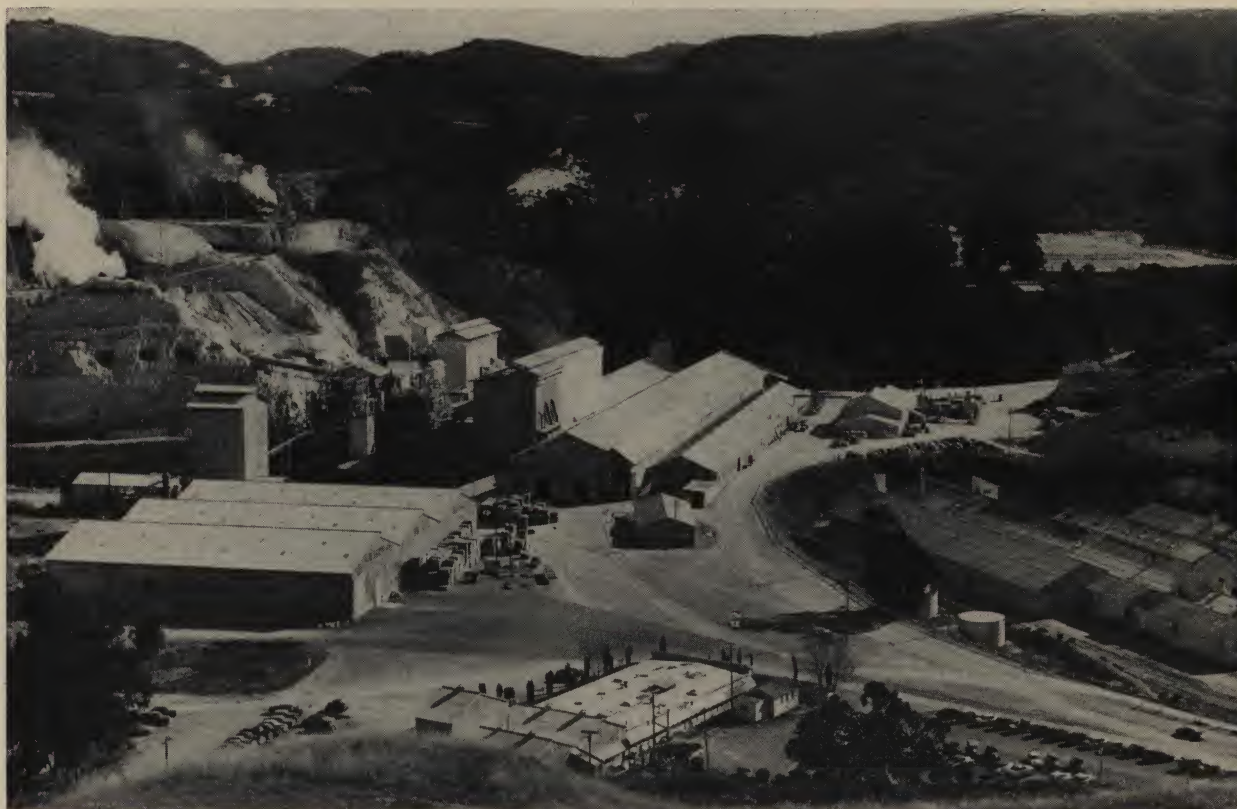
With increased capacity and longer cycles, power charges are lower and production can be obtained with fewer filter units resulting in decreased investment, depreciation, and maintenance costs.

**Increased Recovery:** The use of Celite filter aids causes formation of a porous cake which permits washing with a minimum of solvent to obtain a complete recovery of soluble substances. Yield is also increased by the fact that less frequent cleaning of the filters cuts down liquid losses and so reduces waste.

**Improved Color:** In many cases, a desirable reduction in color is produced by the Celite filter aid removing coloring matter originally present as a fine, insoluble, suspended impurity.

**Celite Filter Aids Are Chemically Inactive:** This makes mechanical clarification possible without affecting in any way the chemical composition, nature, taste, odor, etc., of the liquid.

**Flexibility of Filter Station:** One great advantage of Celite filter aids is the flexibility provided to the filter station. Should increased production be called for, a higher proportion of filter aid will enable the filter area at hand to clarify greatly increased amounts of liquid. Sudden excess requirements or surges of liquid particularly difficult to filter can be handled without additional equipment by merely increasing temporarily the percentage of filter aid employed.



*The modern Celite plant at Lompoc, California*



### Special Filter Aids

In addition to the nine commercial grades discussed, there are available particular Celite filter aids for special conditions. Among these are the following:

**Celite Analytical Filter Aid:** An especially purified material for speeding up laboratory filtrations in chemical or biological work where extreme accuracy is of first consideration.

**Celite 521:** An acid-washed and calcined filter aid particularly suited for the filtration of distilled beverages and the tannin-bearing liquids in general.

**Filter-Cel Laboratory Standard:** This is a completely standardized product and is, therefore, used as

a calibrating filter aid in determining the filtration characteristic of raw sugars and for making other filtration comparisons.

### Engineering Service

The services of the Johns-Manville Filtration Engineering Department are made available without obligation by engineers located at strategic points throughout the country. Full details concerning Celite filter aids, their application or general engineering information incidental to filtration and the clarification of liquids, together with samples and prices, will be sent on request by the Celite Division of Johns-Manville, 22 East 40th Street, New York 16, N. Y.



*One of the fully-equipped laboratories at the J-M Research Center where filter aids are studied and new products are developed*



## Celite Mineral Fillers



*Photomicrograph showing the varied shapes of Celite diatoms. Magnification 500x*

In an ever-increasing range of industries, modern production techniques require the extensive use of fillers to improve finished product quality and to reduce costs. Celite\* Mineral Fillers have many unique physical and chemical properties that make them adaptable for this purpose. These include great bulk per unit of weight, exceptionally high liquid absorption capacity, large specific surface, high porosity, low apparent density, and relative inertness. These properties provide such desired product benefits as added bulk, lighter weight, control of deliquescence, reduction of gloss, increased hardness and toughness, removal of stickiness, control of body, increased melting point, and improved dispersion to name a few.

### Physical and Chemical Properties

The widespread use of Celite Mineral Fillers is attributed to their many unique physical and chemical properties. Following, listed alphabetically, is a comprehensive description of the most important properties.

**Absorption:** Each individual particle of Celite, regardless of how minute in size it may be, is very porous and cellular. The material is, therefore, very absorbent. Some grades will absorb their own weight of liquid while others will absorb up to three times their weight,

the absorption being dependent on several factors including what liquid is used. See Table of Properties.

**Adsorption:** Negligible for most purposes for all grades.

**Bulk:** Celite Fillers are very light in weight, and bulk much more than other type fillers. The loose weight, depending on grade (usage in dry powder mixtures), is from 7 to 18 lb per cu ft. The wet weight (usage in wet paste mixtures) ranges from 17 to 32 lb per cu ft. The molded weight (usage in compositions molded under pressure) ranges in accordance with the very low true specific gravities as listed in the Table of Properties.

**Chemical Composition:** Celite Fillers are composed of nearly pure amorphous diatomaceous silica. Principal minor ingredients include aluminum, iron, calcium, and magnesium, usually combined as silicates and not readily soluble. Water and acid soluble contents are very low. Because of its siliceous composition Celite is inert in filler applications. Celite Fillers are highly fire-resistant, with a melting point above 2900 F. Different grades have pH values ranging from 5.0 to 9.0. See Typical Analysis Table following.

**Color:** The uncalcined grades have a gray color characteristic of the crude rock. The calcined grades are light pink due to traces of oxidized iron. The flux-

\* Reg. U. S. Pat. Off.



calcined grades are processed to produce different degrees of brightness or whiteness in line with the usage requirements. Special grades, produced for use as pigment extenders, have very high brightness comparing favorably with the brightness of white pigments.

**Diatomaceous Structure:** The microphotograph clearly illustrates the diversity of the size, shape and porous nature of the Celite diatoms. Under the microscope these minute diatoms are seen in many unique and beautiful shapes such as stars, pill boxes, needles or spicules, and countless others. Although irregularly shaped, the highly porous structure of Celite is always evident. One cubic inch of these materials contains approximately thirty-five million individual diatoms.

**Fineness:** (See also Particle Size Distribution) Grades of Celite Mineral Fillers are available to cover the range of screen sizes from powder grades with only one half of one percent retained on 325 mesh to aggregate grades having lumps one half inch in diameter. See Table of Properties.

**Hardness:** Hardness of different Celite grades ranges from 4.5 to 6.5 on the Moh scale. However, in some uses the diatomic structure breaks down under pressure lowering appreciably the effective hardness. Certain grades (Snow Floss, Super Floss) are the standard non-scratching, polishing abrasives for many

**TYPICAL CHEMICAL ANALYSIS**  
(Moisture Free Basis)

Composition	Percent by Wt.
Loss on Ignition . . . . .	3.0
SiO <sub>2</sub> . . . . .	89.4
Al <sub>2</sub> O <sub>3</sub> . . . . .	4.1
Fe <sub>2</sub> O <sub>3</sub> . . . . .	1.5
TiO <sub>2</sub> . . . . .	0.1
CaO . . . . .	0.2
MgO . . . . .	0.7
Na <sub>2</sub> O(+K <sub>2</sub> O) . . . . .	0.8
<i>Total</i> . . . . .	<u>99.8</u>

fine polishes. These polishes clean such soft surfaces as aluminum, silver, and automotive finishes without visible scratching.

**Inertness:** (See Chemical Composition.)

**Moisture Content:** The uncalcined grades of Celite Mineral Fillers have a moisture content controlled not to exceed 6 per cent.

The calcined grades are bone dry when produced and do not normally pick up more than 1 percent moisture except in extraordinary circumstances.



*A section of the huge Celite deposit at Lompoc, California. This is the largest uniform deposit of pure diatomaceous silica so far discovered in the world*



**Particle Size Distribution:** The extreme fineness of many Celite Mineral Filler grades cannot be shown by the usual wet screen testing. Particle size analyses (sedimentation method) show many of the Celite grades to be very fine—some averaging one to two microns average particle size. See Table of Properties.

**Porosity:** The highly porous character of Celite Mineral Fillers is well illustrated by the fact that no grade is less than 65 percent porous and some grades approach 95 percent. See also absorption.

**Purity:** Celite is produced from an exceptionally high quality diatomaceous silica crude rock. Physical and chemical processes especially designed for diatomaceous silica guards against contamination and eliminates foreign matter. Grit free grades are available. Even the coarser aggregate grades are diatomaceous silica of very high purity.

**Refractive Index:** Refractive indices for the Celite white grades are in the range from 1.40 to 1.45.

**Solubility:** Although Celite is inert in nearly all filler applications, under the correct conditions of temperature and pressure, it is soluble in strong alkalies. This leads to its use as a source of silica in making ultra-marine blue, lime-silica reaction products and other products where the natural properties of Celite are desired.

**Specific Gravity:** The true specific gravity of uncalcined Celite Mineral Fillers is 2.00; of the calcined fillers, 2.15; and of the flux calcined fillers, 2.30. (Also see Bulk.)

**Specific Surface:** The hollow, thin-walled construction of the Celite diatoms explains the unusually high specific surface or surface area per unit of weight.



*A block of natural Celite is so light it floats easily in water*

Improved methods of measuring this property show some grades to have a specific surface as high as 20 to 25 square meters per gram.

**Uniformity:** Celite Mineral Fillers have a very high degree of uniformity due to a superior crude, a modern plant, high manufacturing standards, rigid control, and the knowledge gained in many years of experience.

### Improved Product Qualities

The use of Celite as a filler in compositions noticeably affects finished product qualities. Following pages show some of the known advantages resulting from the use of Celite Mineral Fillers.

### Properties of Standard Grades of Celite Mineral Fillers

Grade Designation	Color	Fineness	Average Particle Size (Oden Method)	Free Moisture Content	Average Absorption *		Average Bulking Value, lb per cu ft		Specific Gravity
					Water	Linseed Oil	Loose	Wet	
Celite FC	Light gray	Maximum 3% on 150 mesh	4-6 microns	Max 6%	215	205	8	17	2.00
Celite SSC	Light pink	Maximum 5% on 150 mesh	6-8 microns	Max 1%	210	190	9	17	2.15
Celite HSC	White	Maximum 7% on 150 mesh	7-9 microns	Max 1%	220	180	10	17	2.30
Snow Floss	Light gray	Maximum 0.5% on 325 mesh	1-2 microns	Max 6%	210	185	8	22	2.00
Celite 315	Light pink	Maximum 0.5% on 325 mesh	2-3 microns	Max 1%	180	155	8.5	25	2.15
Super Floss	White	Maximum 0.5% on 325 mesh	2-4 microns	Max 1%	150	120	9	27	2.30

\* Gardner-Coleman Method—lb of liquid per 100 lb of Celite.





*Recording data from catalyst evaluating apparatus at the Johns-Manville Research Center*

**Delicate Abrasiveness:** The individual particles of Celite are relatively hard but, in usage, due to the crushing under pressure of the porous, thin-walled diatom structure, a delicate degree of abrasiveness is secured in specially prepared grades. These grit-free grades serve as the standard polishing abrasives in many fine, highest quality, non-scratching silver, pewter, stainless steel, copper and automobile polishes.

**Greater Absorption:** The high absorption characteristics of Celite fillers can be incorporated into compositions in different degrees depending upon formulations and processing.

**Less Adhesion:** When used alone as a dusting agent, or in proper mixtures, Celite acts as a separant or stripping agent. Usage in rubber latex molding techniques is typical of this action.

**Added Bulk:** The light loose weight of Celite can be effectively used to add bulk to a powdered mixture such as a household cleanser or dry dust insecticides. Celite also adds bulk to wet paste compositions such as polishes.

Because of the low true specific gravity, a greater bulk or yield of wet ground or molded products can always be expected when Celite is a component part. See Table of Properties on front of this sheet.

**Caking Prevented:** The addition of from one to five percent of Celite prevents the caking of deliquescent crystalline products such as ammonium nitrate, and preserves free flowing characteristics.

**Better Cleaning Compounds:** The use of Celite in a cleaning or cleanser composition aids the abrasive action without scratching.

**Color:** Alone or in combination with other pigments, the white grades of Celite can improve the color or opacity of certain products such as paints and paper.

**Products Drying Effect:** Because of its high absorption, liquids of any viscosity can be mixed with Celite and a "dry" product obtained. A sticky or greasy product can be converted into a free flowing dust or a firm solid object with the correct amount of Celite. An active liquid chemical can be applied as a powder or paste when dispersed in a Celite filler.

**Higher Product Consistency:** The porosity and high liquid absorptive capacity of Celite generally give higher consistency to pigmented products, such as paints, polishes and similar products.

**Useful Electrical Properties:** Molded plastics products and wire insulations containing Celite filler grades display high dielectric, low power factor, and good arcing resistance.



*Celite is the flattening agent used in the varnish on the right panel; the left is coated with regular, gloss varnish. The glossmeter contrasts the rich, dull sheen caused by Celite with the other mirror-like surface*





*Relative durability and wearing quality of traffic paints—containing Celite and other extenders—are being measured on this road. In addition to lengthening the life of traffic paint, Celite improves night visibility of the stripes and reduces drying time*

**Surface Flatting Effect:** The microscopically fine diatom particles of Celite fillers stick through the surface of a film (such as paint) which is formed without pressure, resulting in a microscopic roughness of the surface which diffuses light and produces a flat finish of any degree from high gloss down to complete flatness.

**Higher Product Melting Point:** Relatively low percentages of Celite will raise the melting point of any binders, such as asphalt. This permits flexibility in the choice of binders and allows different end products.

**Rubber Nerve Reduced:** Celite fillers remove or “kill,” the nerve of certain rubbers or resins. Synthetic rubbers, Buna S and Butyl, are typical of those so effected. The reduction in nerve is permanent and better processing properties result.

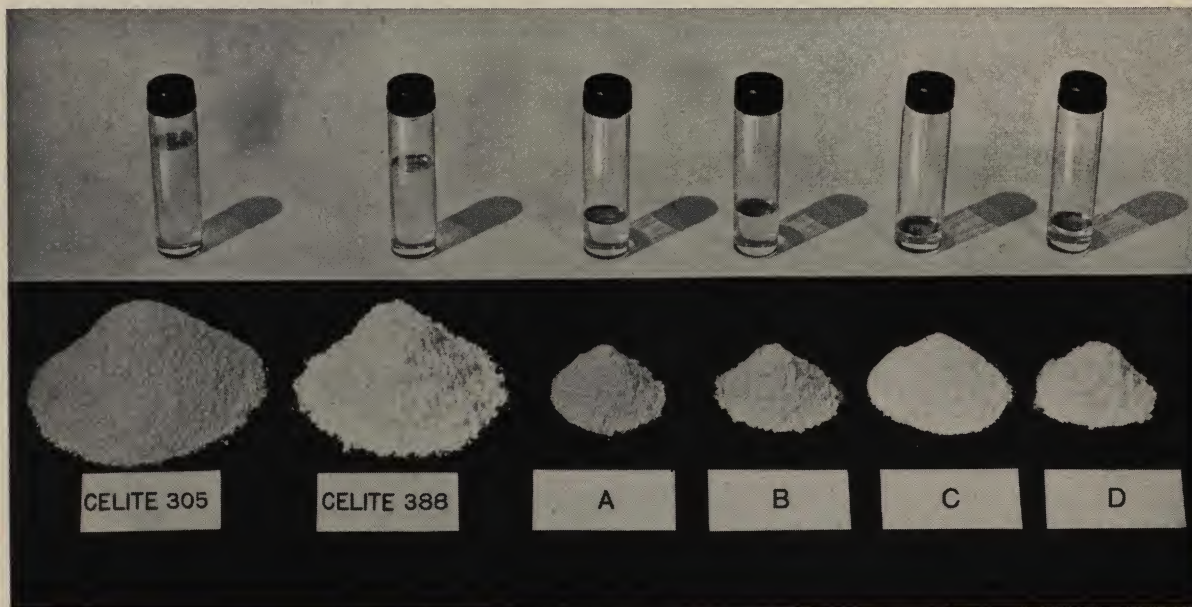
**Improved Molded Surface Gloss:** Celite fillers will produce a superior initial and a more permanent surface gloss and finish in many molded products. This is especially true in phenol formaldehyde compositions. The finish is resistant to heat and moisture.

**Retention of Perfume:** In dry powder mixtures such as dusting powders and cleaners, Celite will absorb and retain perfumes until the package is empty.

**Improved Porosity:** Highly porous molded bodies can be produced with Celite fillers. Liquids and gases can be absorbed in such bodies. A relatively low percentage of a suitable binder is usually used.

**Minimized Shipping Cost:** Products made with Celite fillers usually weigh less, thereby lowering the shipping cost.

**Better Sound Reproduction:** Sound-record compositions filled with special Celite fillers are outstanding in durability and lack of sound distortion.



*The above comparisons show how two Celite grades compare with four commonly used paper fillers. Each pile contains the same weight of filler. The amounts of oil in the bottles are the exact amounts necessary to wet the fillers shown in the piles. Note the large bulk of Celite grades and their high liquid absorptive capacity*



**Increased Stiffening Effect:** A stiffening effect is obtained when Celite is a part of compositions used to coat fabrics. Such products are usually bound with rubber, oil, or lacquer.

**Improved Strength:** The irregularly shaped diatom particles of Celite help the formation of an interlocking skeleton within a product. Improved strength characteristics and toughness can be expected as a result of this reinforcement.

**Desirable Surface Roughness:** A surface roughness can be incorporated in a product by means of Celite fillers which result in a better "bite" in usage. Crayons or erasers are typical products using this advantage.

**Better Suspension:** The light weight, porous nature of Celite causes it to stay in superior suspension and improves the suspension of the other pigments in compositions, such as polishes and paints.

Owing to its particle shape, Celite helps to prevent segregation of the ingredients of a dry powder mixture. Grades with suitable rates of settling in air are available for airplane (insecticide) dusting.

**Practical Translucency:** With so low a refractive index (1.40—1.45 for Celite white grades) and one so similar to that of the ordinary paint vehicles (such as varnish and oil), as well as to that of the transparent synthetic resins, many interesting translucency possibilities are evident.

### Industrial Applications

Following are a few of the products in which Celite fillers are now being used. No effort is made to describe the entire effect of the Celite but rather to point out the outstanding or important effects which warrant these uses. The discussions illustrate the variety and types of uses of these fillers.

**Acetylene Tanks:** Celite Mineral Fillers are a valuable constituent in the monolithic poured filling in acetylene tanks because they help produce a very light weight (shipping), porous, inert sponge which efficiently absorbs the necessary liquid and gaseous chemicals.

**Adhesives:** Small percentages of Celite Fillers are used in a variety of adhesives, principally to increase the viscosity, thereby improving the spreading prop-



*Celite is used in carload lots by many paper manufacturers to improve quality and lower cost*



erties and assuring a heavier coat of cement after pressing.

**Filled Asphalt, Pitches, Bitumens:** In both liquid and solid asphalt-bound products, Celite Fillers are used. Some typical products are expansion joints, wire coatings, adhesives, paints and molded products. Ten to fifteen percent of Celite Fillers will raise the melting point of an asphalt from 20 to 40 F. They will also improve other physical properties such as penetration, brittleness, toughness, and levelling to a degree only to be obtained with 3 to 4 times the weight of heavier fillers. Celite Fillers improve waterproofness because they permit more binder to be used. Lower melting point asphalts can be used with Celite Fillers to obtain higher melting point end products.

**Battery Boxes:** The properties of Celite Mineral Fillers have produced an outstanding product in the case of asphalt or composition molded battery boxes. The purity of Celite Fillers and their low acid solubility makes them especially desirable in this usage. Also, Celite gives much greater heat stability, more toughness and resistance to shock, and produces a lighter weight product. Other applications of Celite Fillers in molded plastics will be noted under the heading Plastics.

**Catalyst Carriers:** Celite has been used for many years as a catalyst carrier where silica is the proper support. Hydrogenation processes involving nickel, oxidation processes using vanadium, polymerization reactions using phosphoric acid and Fischer-Tropsch synthesis reactions using cobalt or iron are typical commercial uses of Celite catalyst carriers.

High porosity, large specific surface, inertness and purity are some of the controllable properties of Celite contributing to its value as a catalyst carrier. Availability in powder, granular, spherular and pellet form makes for flexibility in application. Great resistance to abrasion and alteration or breakdown by high temperature gases contributes to uniformity and stability of catalytic operations.

**Cleansers and Cleaners:** By adding bulk, improving color and increasing the absorption properties for better retention of perfume, Celite Mineral Fillers improve powdered household cleansers. Boiler tube cleaning compounds are also made much more effective by using a substantial amount of Celite Fillers.

**Crayons:** A very high percentage of Celite Fillers is used in artists' crayons, principally because of the bulk it imparts but also because of the better writing and wearing properties.



*Special grades of Celite Fillers are used for silver, automobile and similar polishes*

**Decals:** Surplus ink or pigments are removed from printed surfaces such as decals by the use of the highly absorbent dry Celite powders which only need to be dusted on and brushed off.

**Detergents:** In detergents, Celite Fillers are used for their bulking effect and to keep the detergent free flowing and non-caking.

**Dyes:** A very small percentage of Celite thoroughly mixed with water soluble dyes usually completely controls any tendency of the dye to cake or to lose its free flowing properties.

**Dynamite:** Perhaps the oldest filler use for Celite Fillers is in dynamite where they absorb the liquid nitroglycerine, thereby making a hard cake which can be processed and handled more safely.

**Coated Fabrics:** In the coatings which are applied in the making of coated fabrics, Celite Mineral Fillers find economic use for several reasons: To produce a dull finish; to increase the viscosity of the coating mixture; to help processing and to enable a greater thickness of coating to be applied in a single operation.

**Fertilizer:** From 3 to 5 percent of Celite on the weight of the ammonium nitrate produces the most free flowing, most resistant to caking product that can be made. This control of deliquescence with Celite Fillers is an important fundamental property based on their physical structure, their high absorptive properties and their great bulk.

**Fuels:** Liquid, oil or semi-solid fuels are mixed with highly absorbent Celite to make solid products which are more easily packaged and handled. Also the rate of combustion is controlled.



**Fumigants:** Tough granular grades of Celite Fillers have the property of absorbing large quantities of gaseous or liquid fumigants and of releasing these active chemicals at a controlled rate. These grades have low shipping weight and are inert.

**Gas Purification:** Celite Fillers are used to absorb active chemicals and serve as beds through which gases are passed in order to purify the gases.

**Insecticides:** (See Pesticides.)

**Insulating Blocks:** Celite is one of the essential constituents of high temperature insulating blocks because of its low heat conductivity and high temperature resistance.

**Leather Finishes:** In final finish coats on leather, Celite Fillers are used as a flattening agent. They are used in undercoats to increase viscosity and decrease number of coats applied.

**Lens Polishing:** Special, grit-free grades of Celite Fillers are used for the final polishing operation on plastic lenses.

**Matches:** In match manufacture Celite Fillers play an important part. They are used to absorb and dry the liquid ingredients of the head composition, disperse the active chemicals, control the rate of burning and to kill after-glow.

**Mold Wash:** In mold wash composition Celite Fillers are used to give castings (especially aluminum) a smoother finish, and to control rate of cooling of different parts of casting.

**Mold Lubricant:** Snow Floss is used in parting mixtures which are applied to mandrels or forms on which rubber articles are made by dipping in latex. Celite



*Celite Fillers are used with various binders to form many types of molded articles*

Fillers are also used as a dry powder dusting agent on tacky materials or surfaces.

**Packing for Corrosive Liquids:** Celite powder is used as a porous, absorbent filling around bottles of corrosive chemicals packed in shipping cases. In case of breakage it absorbs the chemicals, preventing spilling, fire and other damage.

**Paint, Enamel, Varnish and Lacquer:** Several special grades of Celite Mineral Fillers are recommended for general use as an inert extender for inside flat wall paints, for flattening, suspension and body; in outside house paints for durability, brushing and whiteness; in primers and undercoats, because of superior filling, sanding and adhesion properties. They are especially effective in traffic or zone paints, giving durability, night visibility, quicker drying and better suspension.

Celite Fillers are also recommended for use as a mineral flattening agent in clear vehicles such as varnish and lacquer, as well as eggshell enamels. They give an attractive, tough, lasting film which is harder and more elastic than obtained by organic flattening agents.

Complete information covering the application of the grades of Celite Mineral Fillers suitable for this work may be obtained upon request.

**Paper:** Celite fillers are used for the control of natural pitch trouble. Also for controlling stickiness caused by resins, inks, asphalts and any other foreign gum. They help formation and are used as an ex-



*Close-up of match sticks passing over the composition drip roll*



tender pigment with  $\text{TiO}_2$  and as a bulking agent. They will improve processing conditions on cylinder machines and give superior board properties and finish.

They are also used in inorganic fibre finishes such as asbestos fibre for drainage and bulking.

**Pesticides:** Celite is widely used in Pesticides as the whole or partial extender, because its use permits the marketing of highest kill power poisons at economic costs. Celite's great bulk, low abrasiveness and the highest liquid absorption power of any commercial extender makes it outstanding as:

(1) *A processing aid:* Enabling the production of dry, free flowing ducts from liquids; gummy, low melting or dense poisons.

(2) *A conditioning agent:* Preventing caking on shelf storage and transportation and increasing flowability in field and applications.

(3) *An insurance agent:* Pesticide concentrates are frequently let down in the field with dense inerts, and often poor results are attributed to the poison. Entomological tests have conclusively shown that the beneficial effects of Celite, originally incorporated by the manufacturer in his concentrate, persist even when the

Celite is diluted to 18 percent or lower, minimizing the results of dense diluents used in the field. Often the manufacturer cannot control the let-down agent utilized in the field, but can assure against bad effects by incorporating Celite in his concentrate.

**Molded Plastics:** Different grades of Celite Mineral Fillers are used as fillers with various binders, such as natural and synthetic resins, gums, shellac, asphalt, gilsonite, rubber and drying oils, to form many types of molded articles. Their use often helps in molding and, depending on the resin employed, improves such properties as mechanical strength, toughness, resistance to water absorption, heat resistance, color, electrical properties, inertness and durability. Reasonable loadings of certain grades of Celite can be incorporated in transparent resins with splendid translucencies resulting. Specific data is available.

Celite Fillers, when substituted for conventional fillers in phenol formaldehyde molding powders, improve surface finish and gloss, both original and on aging. They lower moisture absorption, improve electrical properties and heat resistance. They improve molding flow and shorten the time of cure.



*Dry dusts made fluffy with Celite give better control and spread.  
Celite also permits faster dusting of rowed small foliage*



**Sound Records:** Special, very fine, grit-free grades of Celite improve sound track compositions by decreasing the wear of sound track, lessening sound distortion and increasing toughness.

**Polish:** Special grades of Celite, free of grit and with different degrees of abrasiveness, are used in gold and silver polishes, automobile polishes, glass polishes, furniture polishes, pre-wax cleaners and metal polishes. The grit-free grades, Snow Floss and Super Floss are used in the fine polishes where scratching cannot be permitted. The use of Celite Fillers in polishes is based on their delicate yet effective abrasiveness, high absorption, and good suspension properties. Celite Fillers are inert and compatible with other ingredients necessary to produce emulsions and pastes.

**Polishing Cloths and Papers:** Celite Fillers are used in polishing cloths and polishing papers. The Celite Fillers are either incorporated as an integral part of the paper or are a part of the composition which is saturated into the cloth or the paper. The polishing and absorbing action of the very fine grades of Celite Fillers produce high quality, scratch-free products.

**Soap:** The delicate abrasiveness, good color, and absorbing properties of Celite Mineral Fillers are valuable in producing the highest quality, abrasive hand soap in cake form.

**Sponge Rubber:** In the production of certain types of sponge rubber, Celite Fillers are very helpful. The high absorption, bulk and diatomite structure of Celite Fillers cause a breakdown or killing of the nerve of the rubber, thereby producing a much more uniform and satisfactory sponge formation. As a filler in this application Celite promotes cured stiffness.

**Seed Coating:** The great liquid absorptive capacity, great bulk and inert nature of Celite Fillers make them valuable in seed coating compositions. Celite Fillers absorb the liquid nutrients, fumigants, or any other essential active constituents, and gives the coating mixture the proper consistency for handling and for coating purposes. Whether the composition is a thin wash coating or a plastic in which the seed is imbedded, the non-alkaline Celite Fillers offer ideal properties for this application.

**Ultramarine Blue:** Typical of the use of Celite Fillers as a source of silica is in the manufacture of ultramarine blue. The ready solubility of Celite Fillers in strong alkalies or when fused make them an ideal source of silica. In the ultramarine blue application, the large bulk of Celite Fillers help fluff up the reaction mass thereby expediting the reaction. The high purity of Celite Fillers produce superior shades.



*In the Johns-Manville Research Center, projects initiated in the adjacent laboratory may be carried clear through their development and pilot plant production stages to the point where they are ready for commercial manufacture*







FRICTION MATERIALS



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## Friction Materials

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(For complete list of data sheets, see other side of this page)



## Friction Materials

### *Complete List of Data Sheets Available*

★Characteristics of J-M Industrial Friction Materials . . . . .	FR-30 and 31
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Eel-Slip Material:	
Description . . . . .	FR-500
Use in paper industry . . . . .	FR-510 and 511
★Fastening friction materials . . . . .	FR-40 and 41
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★Moulded Linings and Facings . . . . .	FR-1
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## J-M Industrial Friction Materials



Satisfactory performance of friction materials in the operation of modern industrial equipment is next in importance only to the generation of adequate power for operating the machine itself.

Throughout the years, from the time when experiments with asbestos resulted in the first successful high-speed industrial friction material, Johns-Manville has produced frictions to withstand the ever-increasing loads and speeds of modern equipment. They possess to an unusual degree the fundamental characteristics required for satisfactory service—mechanical strength, resistance to heat and shock, and durability. On shovels, drag lines, hoists, winches, cranes, presses, and on a variety of other industrial and marine equipment, J-M Industrial Friction Materials have proved to be outstanding in combining maximum braking efficiency with low maintenance costs and power economies.

J-M Industrial Friction Materials are made in both flexible and rigid styles. The flexible styles, which include the various woven, woven and compressed, and folded and compressed materials, are most suitable for

average and high-speed operation. They have high frictional value and maintain a relatively constant coefficient of friction through a wide range of temperature. Possessing a certain amount of resiliency, the flexible linings conform readily to friction surfaces and do not require the wearing-in period sometimes experienced with rigid styles.

The rigid friction material styles are noted for mechanical strength, uniformity of friction, smooth quiet operation and long life in severe low or average speed service. The wearing-in period of these materials is relatively short when compared with that of other rigid linings. Because of their high mechanical strength, they are particularly adapted to severe shock service where there is a tendency to crush or shear the friction material because of the sudden application of heavy loads.

**Choosing the Proper Friction:** From the tables and descriptive matter which follow, the selection of the proper friction material for any given set of service conditions can be readily determined.



## Description of J-M Industrial Friction Materials

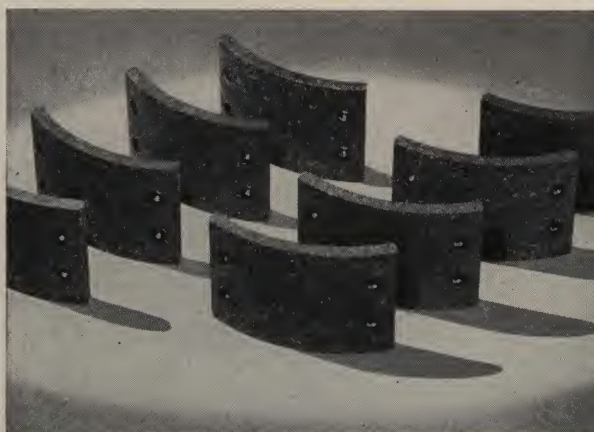
### Moulded Blocks and Facings

The three styles in this group are rigid moulded materials particularly adaptable to severe shock service.

Style No. 100: Designed to meet requirements for a material with a low coefficient of friction. It is particularly suitable for use against surfaces where smooth, continuous tension is needed. Contains metal particles.

Style No. 140: Used where a material with high heat resistance and low rate of wear is required. Contains metal particles.

Style No. 150: Particularly applicable for heavy duty service in clutches and brakes on earth-moving equipment. Contains metal and friction particles.



Moulded Friction Blocks

### Moulded Linings and Facings

The six styles in this group consist of rigid moulded and semi-flexible materials which serve in the medium-duty field.

Style No. 200: Designed so that either side can be used as the wearing surface. When furnished in facing form, this style is suitable for floating disc clutches. Has a low metal content.

Style No. 230: Possesses high heat resistance and provides long, economical service under shock-load. Does not contain metal particles.

Style No. 232: A coil-block lining identical in composition to Style No. 230 except it is furnished in continuous coils of 10½ ft per coil, two coils per package. This lining is semi-

flexible and can be applied to bands or shoes of any diameter of 18" or larger. Applicable to either "internal expanding" or "external contracting" wrap bands or shoes; when ordering, state which.

Style No. 240: A superior moulded lining, with good resistance to wear and stabilized friction characteristics, for all usual operating conditions. Contains metal particles.

Style No. 242: A coil-block lining identical in composition to Style No. 240 and furnished the same as Style No. 232.

Style No. 751: Made from asbestos millboard and furnished as friction facings only. Best suited for light shock service.

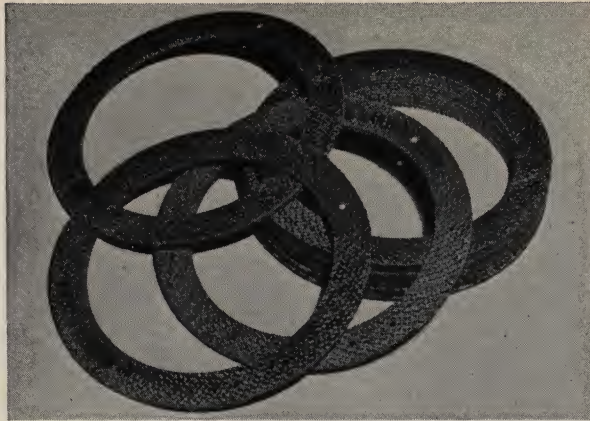
### J-M Industrial Friction Materials (For use against Cast-iron or Steel Surfaces)

Type of Friction Material	Style No.	Disc (D) Cone (C) Band (B)	Type of Structure	Temp. Range, F		Rubbing Speed, Max. fpm	Braking Pressure, Max. psi	Coefficient of Friction	Resistance to Shock	Rate of Wear
				Constant	Short Period					
Moulded Blocks & Facings	100	D-C-B	Rigid Moulded	750	1000	5000	150	0.25±.05	Excellent	Excellent
	140	D-C-B	Rigid Moulded	750	1000	7500	150	0.40±.07	Excellent	Excellent
	150	D-C-B	Rigid Moulded	750	1000	7500	150	0.45±.07	Excellent	Excellent
Moulded Linings and Facings	200	D-C-B	Rigid Moulded	500	750	5000	100	0.40±.05	Good	Medium
	230	D-C-B	Rigid Moulded	500	750	5000	100	0.45±.07	Good	Excellent
	232	C-B	Semi-Flexible	500	750	5000	100	0.45±.07	Good	Medium
	240	D-C-B	Rigid Moulded	500	750	5000	100	0.40±.07	Good	Excellent
	242	C-B	Semi-Flexible	500	750	5000	100	0.40±.07	Good	Medium
	751	D	Rigid Moulded	500	750	5000	100	0.35±.07	Good	Good
Woven Linings and Facings	300	B	Flexible	250	500	5000	50	0.40±.07	Medium	Medium
	304	B	Flexible	500	750	5000	100	0.20±.07*	Medium	Variable**
	350	D-C	Semi-Flexible	500	750	5000	100	0.35±.07	Good	Good
	354	D-C	Semi-Flexible	500	750	3000	50	0.20±.07*	Medium	Variable**
	400	B	Semi-Flexible	500	750	7500	100	0.45±.07	Good	Good
	404	B	Semi-Flexible	500	750	5000	100	0.20±.07*	Medium	Variable**
	450	D-C	Semi-Flexible	500	750	3000	100	0.45±.07	Good	Good
	454	D-C	Semi-Flexible	500	750	3000	100	0.20±.07*	Medium	Variable**
	510	B	Flexible	500	750	7500	100	0.45±.07	Good	Good
	600	D-C-B	Semi-Flexible	350	600	3000	100	0.45±.07	Excellent	Excellent
	900	D-C-B	Semi-Flexible	500	750	5000	100	0.45±.07	Good	Excellent
Giant Rotary Linings	410	B	Semi-Flexible	For additional data on these three styles for the oil industry, consult the nearest Johns-Manville office. Results vary with field conditions and individual practices.						
	420	B	Semi-Flexible							
	430	B	Semi-Flexible							

\* Coefficient of friction running in oil. \*\* Depending on amount of oil.

NOTE: Sizes (thicknesses, diameters, widths, lengths) of all styles are given in the tables on following data sheets under "Selection of J-M Friction Materials."



*Woven Facings*

### Woven Linings and Facings

The eleven styles in this group, ranging from extreme flexibility to dense, semi-flexibility, offer a very broad choice in this type of material. They are readily adaptable to all sizes of drums and conform easily to the friction surfaces.

Style No. 300: Developed for high speed, light-load service. Conforming quickly to slight drum irregularities, it is particularly adaptable where no breaking-in period is possible. Contains wire-inserted asbestos yarns.

Style No. 304: Similar in structure to Style No. 300, but impregnated with an inorganic compound unaffected by oil.

Style No. 350: The "standard woven" facing for general purpose service is available "solid" or "formed and joined." Contains wire-inserted asbestos yarns with heat-resisting impregnation.

Style No. 354: Similar to Style No. 350 except it is impregnated with an oil-resisting compound. Designed for clutches running in oil or where oil is present on the friction surface.

Style No. 400: An exceptionally durable woven lining for moderate shock-load, high-pressure service. Impregnated with a special heat-resisting compound which reduces smoking and dusting to a minimum. Contains wire-inserted asbestos yarns.

Style No. 404: Similar to Style No. 400 except for impregnation with an oil-resisting compound.

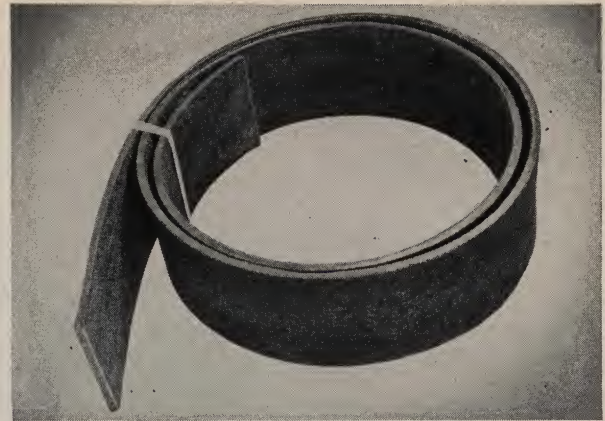
Style No. 450: A heavy duty woven facing furnished only in endless ring form or in keystone segments as the material cannot be curved edgewise. Contains wire-inserted asbestos yarns and a heat-resisting impregnation.

Style No. 454: Similar in structure to Style No. 450 except for impregnation with an oil-resisting compound.

Style No. 510: A dense, solid woven lining with a synthetic resinous impregnation. Has exceptional non-scoring properties and mechanical strength, with the surface ground to assure maximum contact with the drum. Contains wire-inserted asbestos yarn.

Style No. 600: A folded and compressed material which has served for many years as the standard general utility lining. Its wide range of application and low rate of wear make it particularly adaptable to field replacements, especially on worn drums. Because of the ground faces, shorter wearing-in periods are possible. Its strength permits duty for heavy shock service. When used as facings, the material is die-formed or cut from sheet stock as endless rings. Contains wire-inserted asbestos yarn.

Style No. 900: A woven and compressed, general utility material which, because of its solid woven structure, is free

*Folded and Compressed Lining*

from ply-separation. The ground faces shorten the wearing-in period. Its strength affords efficient service under shock loads, while the low rate of wear effects marked service economies. In facing form, the common form of ring is cut from flat stock. Cone-clutch facings must be mould-formed. Contains wire-inserted asbestos yarn.

### Giant Rotary Linings

J-M Giant Rotary Linings were designed specifically for the oil-well drilling industry. They are woven from high quality, wire-inserted asbestos yarn and are specially impregnated to assure a resilient though uniformly compact and dense lining. The three grades following are offered to meet varying drilling requirements, shock loads, and to provide an even feed-off resulting in better control of drilling. Care has been exercised to provide a fine balance between drum abrasion and heat checking of drums. Wear on the lining saves wear on the drums.

Style No. 410: For use on draw works engaged in drilling wells of average depth. Furnished unground only.

Style No. 420: The sturdiest woven lining suitable for the severest service in oil-drilling operations. Applicable to wells of all depths but used regularly on deep drilling operations in the severest formations. Supplied unground; ground on special order.

Style No. 430: Designed for average depth wells, rework rigs, etc., where it has proved to be outstanding. The lining is readily adaptable to varying drum sizes. Supplied unground; ground on special order.

### Rivet Hole Plugs

J-M Rivet Hole Plugs, used for filling the counterbores in holes through friction linings, reduce scoring tendencies by preventing accumulation of foreign matter and also increase the total effective braking surface.

Style No. 1200-S: Furnished in stick form which can be cut off in lengths to fit counterbores. When ordering, give diameter of counterbore.

Style No. 1200-F: Furnished as densely compressed plugs made to correct size and thickness so that they will completely fill the counterbores. When ordering give depth and diameter of counterbores as well as number of counterbores required.

### DESCRIPTION OF J-M INDUSTRIAL FRICTION MATERIALS

August, 1947 (Cancelling FR-15 and FR-20 dated August, 1939)

FR-2



## Chord-Arc Conversion Table for Friction Blocks

Prices of plain curved brake blocks are determined from a standard list. These prices are based on a per lin. ft. long-arc length. Curved block sizes are sometimes given in long or short-chord lengths. The following table and method are used to transpose chord lengths into arc lengths.

Chord÷Radius Col. (A)	Arc÷Chord Col. (B)	Chord÷Radius Col. (A)	Arc÷Chord Col. (B)
0.2611	1.000	1.3121	1.090
0.4329	1.008	1.3767	1.103
0.5512	1.013	1.4387	1.116
0.6346	1.017	1.4979	1.130
0.7167	1.022	1.5543	1.145
0.7975	1.028	1.5973	1.158
0.8767	1.035	1.6282	1.168
0.9543	1.042	1.6483	1.175
1.0301	1.050	1.6678	1.182
1.1039	1.059	1.6961	1.193
1.1756	1.068	1.7143	1.201
1.2450	1.079	1.7492	1.217

### Procedure

#### Blocks With Radial Ends (Fig. 1):

Given: Inner or short chord C, radius R and thickness T. To find long arc L.

Divide the chord C by the radius R and select, in col. (A), the next higher number than this quotient. Multiply the corresponding number in col. (B) by the chord C times the radius R plus thickness T, and divide the result by radius R. The final result will be the arc length L of the block.

Example:  $R=8"$ ,  $C=7\frac{3}{4}"$ ,  $T=\frac{3}{4}"$

$$7.75 \div 8 = 0.9687$$

Next higher number in col. (A) = 1.0301

Corresponding number in col. (B) = 1.05

(Chord) times (radius plus thickness) =  $7.75 \times 8.75 = 67.81"$

Length of block =  $(1.05 \times 67.81) \div 8 = 8.9"$

Error: The accurate length of the block is 8.85"

$$8.9" - 8.85" = 0.05" \text{ or } 0.57 \text{ percent}$$

(Maximum error will not be over 1 percent)

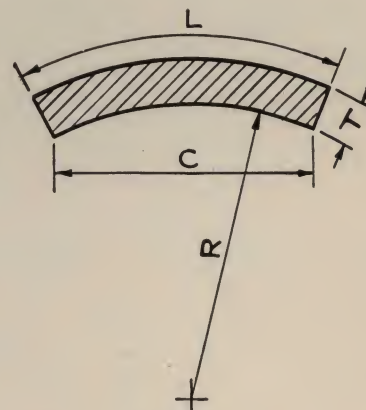


FIG. 1

#### Blocks With Parallel Ends (Fig. 2):

Given: Inner chord C, radius R and thickness T. To find long arc L.

Divide the chord C by the radius R plus thickness T and select, in col. (A), the next higher number than this quotient. Multiply the corresponding number in col. (B) by the chord C. The result will be the length of the arc length L of the block.

Example:  $R=12"$ ;  $C=8"$ ;  $T=1"$

$$8 \div (12+1) = 0.615$$

Next higher number in col. (A) = 0.6346

Corresponding number in col. (B) = 1.017

Chord times 1.017 =  $8 \times 1.017 = 8.136"$

Length of block = 8.136"

Error: The accurate length of the block is 8.132"

$$8.136" - 8.132" = 0.004" \text{ or } 0.05 \text{ percent}$$

(Maximum error will not be over  $\frac{1}{10}$  of 1 percent)

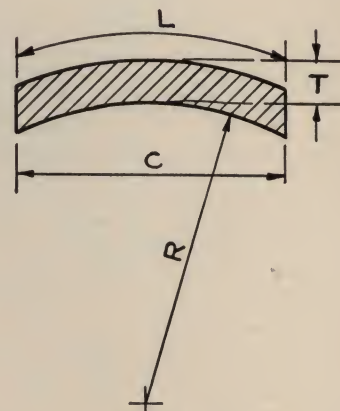


FIG. 2



## Selection of J-M Industrial Friction Materials

STYLE NO.*	100	140	150	200	230	232	240	242	300	304	350	354	400	404	450	454	510	600	751	900
TYPE OF BRAKE OR CLUTCH Discs or Steel Drums & Discs	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND	DISC CONE BAND
TYPE OF SURFACE †Furnished standard with ground surface	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
STRUCTURE R = Rigid Moulded SF = Semi-Flexible F = Flexible	R	R	R	R	R	SF	R	SF	F	F	SF	SF	SF	SF	SF	SF	F	SF	R	SF
COEFFICIENT OF FRICTION ‡Running in oil	0.25 ±0.05	0.40 ±0.07	0.45 ±0.07	0.40 ±0.07	0.45 ±0.07	0.45 ±0.07	0.40 ±0.07	0.40 ±0.07	0.40 ±0.07	0.20‡ ±0.07	0.35 ±0.07	0.30‡ ±0.07	0.45 ±0.07	0.20‡ ±0.07	0.45 ±0.07	0.20‡ ±0.07	0.45 ±0.07	0.45 ±0.07	0.35 ±0.07	0.45 ±0.07
THICKNESS	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
MAX. DIAM.	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"
THICKNESS	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"	35"
WIDTH	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.
MAX. LENGTH	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.	120" OF CIRC. BUT NOT OVER 24" LONG CHORD—MAX. AREA 600 SQ. IN.
TYPE OF SERVICE	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
MAX. RUBBING SPEED FT/MIN	5000	7500	7500	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
MAX. DRUM TEMP. °F FOR CONSTANT OPERATION	750	750	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
MAX. PRESSURE—Psi	150	150	150	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
RESISTANCE TO SHOCK	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
RATE OF WEAR	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E

Note 1—Blocks over 14" wide cannot be ground on I.D.; Blocks 24" wide, less than 1/2" thick, cannot be ground, I. D. or O. D.

Note 2—Style 600 Lining is furnished unground over 18" wide.

Note 3—Full moulded to 1/2" thick and 35" O.D. Saw cut from slab over 1/2" thick to 2 1/2" and max. O.D. of 24".

Note 4—1/4" thick to 3/8" thick-12" diam. Max.

\* For performance characteristics of Styles No. 410, 420 and 430 consult the nearest J-M office.

The above chart has been prepared to simplify the selection of friction materials. The following example illustrates its use.

A friction material 1/4" thick and 4" wide with a coefficient of friction of 0.40 is required for an external contracting band type clutch operating under average loading and the following conditions: rubbing speed 3000 fpm; dry operation; pressure 75 psi; drum temperature 500 F; constant operation. The friction material selected must have a good rate of wear, and a rigid moulded type material is desired.

The chart shows 15 styles of friction materials suitable for band type clutches. The selection, therefore, lies with Styles 100, 140, 150, 200, 230, 232, 240, 242, 300, 304, 400, 404, 510, 600 and 900, and since 1/4" thick material is specified, this elimi-

nates Styles 100, 140, 150, 400 and 404. Requirement for dry operation eliminates Style 304, requirement for 75 lb pressure eliminates Style 300 and drum temperature of 500 F eliminates Style 600.

The selection would then lie between Styles 200, 230, 232, 240, 242, 510 and 900. The preference expressed for a rigid moulded structure eliminates Styles 232, 242, 510 and 900, leaving Styles 200, 230 and 240 as final choice. After reference to the chart on characteristics of J-M Industrial Linings and Brake Blocks, Style 240 would be indicated as final selection due to its metal particle content which gives a slightly better wear factor and somewhat more stabilized friction than Styles 200 and 230.



## J-M Friction Material Characteristics

## CHARACTERISTICS OF J-M FRICTION FACINGS

MATERIAL	COEFFICIENT OF FRICTION	SIZE LIMITS	TOLERANCES		SERVICE CONDITION																																																																																							
			THICKNESS	Diameters and Flange Width																																																																																								
STYLE No. 100 Friction Facing Metal Particle	0.25 ± .05	Thickness—1/4" to 1/2" thick inclusive to 35" O.D. maximum in full moulded type Saw cut from slab stock to 2-1/2" thick to maximum diameter of 24"	± 1/32"	Diameters—O.D. ± 1/16" I.D. +1/18"-0.00"	Dry																																																																																							
STYLE No. 140 Friction Facing Metal Particle	0.40 ± .07				Dry																																																																																							
STYLE No. 150 Friction Facing Friction Particle	0.45 ± 0.07				Dry																																																																																							
STYLE No. 200 Moulded Facing Metal Content	0.40 ± .07	Thickness—3/16" to 3/8" incl. Diameter—40" max.; flange width—18"	± .010"	Diameters—O.D. to 12", ± 1/32" O.D. 12" and larger ± 1/16" I.D. to 12", +1/18"-0.00" I.D. to 12" and larger, +1/8", -0.00"	Dry																																																																																							
†STYLE No. 230 Moulded Facing No Metal	0.45 ± .07	Thickness—3/16" to 3/8" incl. Solid Facings—16" O.D. max.; Flange width—8" Segmental Facings—18"-22" O.D. 2 pcs.; 22"-30" 4 pcs.																																																																																										
†STYLE No. 240 Moulded Facing Metal Particle	0.40 ± .07	Thickness—3/16" to 3/8" incl. Solid Facings—20" O.D. max.; Flange width 10" Segmental Facings—20"-30" O.D. Incl., 2 pcs.																																																																																										
STYLE No. 350 Standard Woven Facing Formed and Joined Wire Inserted	0.35 ± .07	Thickness—1/8" to 5/16" inclusive Diameter—4" to 24" O.D. Over 24" O.D. Spec. Maximum Flange Widths as follows:	± .010"	Diameters—To 18" O.D. and under 3" flange width ± 1/16" To 18" O.D. and flange width 3" and over ± 3/32" 18" to 24" O.D. ± 1/4" Over 24" to 48" O.D. ± 1/2" Over 48" O.D. ± 1"	Dry or Oil																																																																																							
		<table><tr><th>O.D.</th><th>1/8" to 5/32"</th><th colspan="3">Thickness</th><th></th></tr><tr><td></td><td></td><th>3/16"</th><th>1/4"</th><th>5/16"</th><td></td></tr><tr><td>4"</td><td>1/2"</td><td></td><td></td><td></td><td></td></tr><tr><td>5"</td><td>3/4"</td><td></td><td></td><td></td><td></td></tr><tr><td>6"</td><td>1-1/4"</td><td>1"</td><td>3/4"</td><td></td><td></td></tr><tr><td>7"</td><td>1-1/2"</td><td>1-1/8"</td><td>7/8"</td><td></td><td></td></tr><tr><td>8"</td><td>1-3/4"</td><td>1-1/4"</td><td>1"</td><td></td><td></td></tr><tr><td>9"</td><td>2"</td><td>1-1/2"</td><td>1-1/4"</td><td></td><td></td></tr><tr><td>10"</td><td>2-1/4"</td><td>1-3/4"</td><td>1-1/2"</td><td></td><td></td></tr><tr><td>11"</td><td>2-1/2"</td><td>2"</td><td>1-7/8"</td><td></td><td></td></tr><tr><td>12"</td><td>3"</td><td>2-1/2"</td><td>2-1/4"</td><td>2"</td><td></td></tr><tr><td>13"</td><td>3-1/2"</td><td>2-3/4"</td><td>2-1/2"</td><td>2"</td><td></td></tr><tr><td>14"-18"</td><td>4"</td><td>3-1/2"</td><td>3"</td><td>2-1/4"</td><td></td></tr><tr><td>19"-23"</td><td>4-1/2"</td><td>4-1/2"</td><td>4"</td><td>2-1/2"</td><td></td></tr><tr><td>24"-36"</td><td>4-1/2"</td><td>4-1/2"</td><td>4"</td><td>3"</td><td></td></tr></table> <p>Over 36"— 1/8" thick 3-1/2", 5/32" to 5/16" thick 4-1/2" Facings under 8" O.D.—Endless recommended.</p>				O.D.	1/8" to 5/32"	Thickness						3/16"	1/4"	5/16"		4"	1/2"					5"	3/4"					6"	1-1/4"	1"	3/4"			7"	1-1/2"	1-1/8"	7/8"			8"	1-3/4"	1-1/4"	1"			9"	2"	1-1/2"	1-1/4"			10"	2-1/4"	1-3/4"	1-1/2"			11"	2-1/2"	2"	1-7/8"			12"	3"	2-1/2"	2-1/4"	2"		13"	3-1/2"	2-3/4"	2-1/2"	2"		14"-18"	4"	3-1/2"	3"	2-1/4"		19"-23"	4-1/2"	4-1/2"	4"	2-1/2"		24"-36"	4-1/2"	4-1/2"
O.D.	1/8" to 5/32"	Thickness																																																																																										
		3/16"	1/4"	5/16"																																																																																								
4"	1/2"																																																																																											
5"	3/4"																																																																																											
6"	1-1/4"	1"	3/4"																																																																																									
7"	1-1/2"	1-1/8"	7/8"																																																																																									
8"	1-3/4"	1-1/4"	1"																																																																																									
9"	2"	1-1/2"	1-1/4"																																																																																									
10"	2-1/4"	1-3/4"	1-1/2"																																																																																									
11"	2-1/2"	2"	1-7/8"																																																																																									
12"	3"	2-1/2"	2-1/4"	2"																																																																																								
13"	3-1/2"	2-3/4"	2-1/2"	2"																																																																																								
14"-18"	4"	3-1/2"	3"	2-1/4"																																																																																								
19"-23"	4-1/2"	4-1/2"	4"	2-1/2"																																																																																								
24"-36"	4-1/2"	4-1/2"	4"	3"																																																																																								
STYLE No. 354 Standard Oil-Resisting Woven Facing Formed and Joined Wire Inserted	0.20 ± .07 Running in oil		± .015"	Flange Width—To 18" O.D. and under 3" flange ± 1/16" To 18" O.D. and flange width 3" and over ± 3/32" Over 18" O.D. and under 3" flange ± 1/8" Over 18" O.D. and flange width 3" and over ± 1/4"	Oil																																																																																							
STYLE No. 350 Standard Woven Facing Endless Wire Inserted	0.35 ± .07	Thickness—1/8" to 5/16" inclusive Diameter—1/8" to 1/4" thick, 23" max. 5/16" thick, 15" max.	± .010"	Diameters—Up to 12" O.D. ± 1/32" 12" to 18" O.D. ± 1/16" 18" to 22" O.D. ± 1/8" Over 22" O.D. ± 1/4"	Dry or Oil																																																																																							
STYLE No. 354 Standard Oil-Resisting Woven Facing, Endless	0.20 ± .07 Running in oil		± .015"		Oil																																																																																							
STYLE No. 450 Giant Woven Facing, Endless Wire Inserted	0.45 ± .07	Thickness—3/8" to 1" inclusive Thicknesses over 1/2" are saw cut	+.015" -.010"	Diameters—O.D. and I.D. under 1/2" thick ± 1/18" O.D. and I.D. 1/2" thick and over ± 1/8"	Dry or Oil																																																																																							
STYLE No. 454 Giant Oil-Resisting Woven Facing Endless Wire Inserted	0.20 ± .07 Running in oil	Diameter—12" O.D. maximum 10" I.D. maximum			Oil																																																																																							
STYLE No. 600 Folded and Compressed Facing Wire Inserted	0.45 ± .07	Thickness—1/8" to 1" inclusive Diameter—To 36" inclusive	± .015"	Diameters—I.D. and O.D.—1/8" and 3/16" thick: To 12" O.D. ± 1/32", over 12" O.D. ± 3/32" I.D. and O.D.—1/4" thick and up: To 12" O.D. ± 1/16", over 12" O.D. ± 3/32" Flange Width—1/8" and 3/16" thick: To 12" O.D. ± 1/32", over 12" O.D. ± 3/32" 1/4" thick and up: To 12" O.D. ± 1/16", over 12" O.D. ± 3/32"	Dry																																																																																							
STYLE No. 751 Asbestos Friction Facing Die or Saw Cut	0.35 ± .07	Thickness—1/8" to 1/2" inclusive Diameter—Ground face to 36" O.D. when width of flange is under 10"	Ground ± .010"	Diameters—O.D. and I.D. To 12" O.D. inclusive ± 1/32" Over 12" to 18" O.D. inclusive ± 1/18" over 18" to 22" O.D. inclusive ± 1/8" Over 22" O.D. ± 1/4"	Dry or Limited Oil																																																																																							
STYLE No. 900 Woven and Compressed Facing Wire Inserted	0.45 ± .07	Thickness—1/4" to 3/8" inclusive Diameter—1/4" thick—1" to 24" O.D. incl. Over 1/4" thick—to 12" O.D. incl.	± .015"	Diameters—I.D. and O.D. To 12" O.D. ± 1/16", over 12" to 24" O.D. ± 3/32" Flange Width—To 12" O.D. ± 1/18", over 12" O.D. to 24" O.D. ± 3/32"	Dry																																																																																							

† Not suitable for floating disc clutch.



## J-M Friction Material Characteristics

## TOLERANCES ON HOLE LOCATIONS DRILLED WITH TEMPORARY TEMPLATE AND PERMANENT JIG

MATERIAL	SIZE	TEMP.	JIG	MATERIAL	SIZE	TEMP.	JIG	MATERIAL	SIZE	TEMP.	JIG
STYLE No. 900 and STYLE No. 900	Up to 12" O.D.	± 1/32"	± 1/64"	STYLE No. 350 Formed and joined and STYLE No. 354 Formed and joined	Flange up to 3" or Up to 16" diameter	± 1/32"	± 1/64"	STYLE Nos. 100 140 150 200 230 240	Up to 12" O.D.	± 1/32"	± 1/64"
	12" to 16" O.D.	± 3/64"	± 1/32"		Flange 3" and up, Up to 16" diameter	± 3/64"	± 1/32"		12" to 16" O.D.	± 3/64"	± 1/32"
	16" O.D. and Over	± 3/32"	—		16" and Over	± 3/32"	—		16" and over	Close as possible	—
STYLE No. 350 Endless and STYLE No. 354 Endless	Up to 12" O.D.	± 1/32"	± 1/64"	STYLE No. 450 and STYLE No. 454	All sizes	± 1/32"	—	STYLE No. 751	Up to 12" O.D.	± 1/64"	± .01"
	12" to 16" O.D.	± 3/64"	± 1/32"						12" to 16" O.D.	± 1/32"	± 1/64"
	16" and over	± 3/32"	—						16" to 36" O.D.	± 3/32"	—

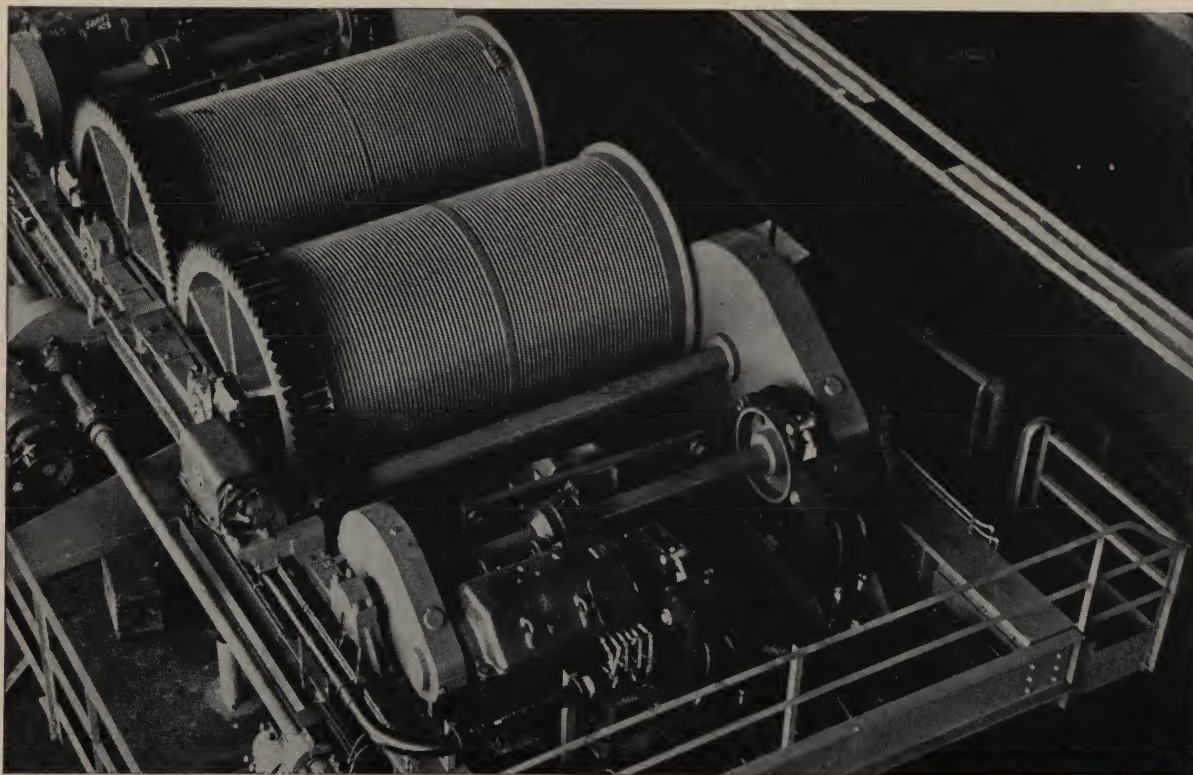
## CHARACTERISTICS OF J-M INDUSTRIAL LININGS AND BRAKE BLOCKS

MATERIAL	COEFFICIENT OF FRICTION	SIZE LIMITS	STANDARD LENGTHS	TOLERANCES		SERVICE CONDITIONS
				THICKNESS	WIDTH, LENGTH AND RADIUS	
STYLE No. 100 Friction Block Metal particle-ground surface	0.25 ± .05	Thickness—3/8" to 3" incl. Width 1" to 24" incl. (Blocks over 14" wide cannot be ground on I.D.) (Blocks 24" wide, less than 1/4" thick, cannot be ground)	Max. Length—120" of circumference but not over 29" long chord. Max. area 600 sq. ins.	Up to 8" wide +.000" —.020" Over 8" wide +.000" —.032"	Width—Up to 8" ± 1/32" Over 8" ± 1/16" Length—± 1/16" Radius of machined block +1/16", —0" Radius of plain moulded block ± 1/8"	Dry**
STYLE No. 140 Friction Block Metal particle-ground surface	0.40 ± .07					
STYLE No. 150 Friction Block Friction particle-ground surface	0.45 ± .07					
STYLE No. 200 Moulded Friction Lining Metal content-ground surface	0.40 ± .05		Max. Length—10' 6" coil			
STYLE No. 230 Moulded Friction Lining No metal-ground surface	0.45 ± .07		Max. Length—120" of circumference but not over 29" long arc. Max. area 600 sq. ins.			
STYLE No. 232 Flexible Moulded Lining No metal-ground surface	0.45 ± .07	Thickness—1/8" to 3/8" incl. Width—1" to 12" incl.	Max. length—10' 6" coil	All thicknesses +.000" —.020"	Width—1" and over ± 1/16" Length—± 1/16" Radius—Up to 8" developed length of arc ± 1/16" Over 8" to 12" developed length of arc ± 3/16" Over 12" developed length of arc ± 1/4"	Dry
STYLE No. 240 Moulded Friction Lining Metal particle-ground surface	0.40 ± .07		Max. Length—120" of circumference but not over 29" long arc. Max. area 600 sq. ins.		ⓈNo radius tolerances on Styles 232 and 242.	
STYLE No. 242 Flexible Moulded Lining Metal particle-ground surface	0.40 ± .07		Max. Length—10' 6" coil			
STYLE No. 300 Standard Woven Lining Wire inserted-unground surface	0.40 ± .07	Thickness—1/8" to 5/16" incl.	25' and 50' rolls	All thicknesses ± .010"	Width—To 12" wide incl., all thicknesses ± 1/16" Over 12" wide, all thicknesses ± 5/16"	Dry
STYLE No. 304 Std. Oil-Resisting Woven Lining Wire inserted-Unground Surface	0.20 ± .07 Running in oil	Width 1" to 24" incl.			Length—± 5' of 25' or 50' roll	Oil
STYLE No. 400 Giant Woven Lining Wire inserted-Unground Surface	0.45 ± .07	Thickness—3/8" to 1-1/8" incl. Width—2" to 12" incl.	To 1/2" thick—50' rolls Over 1/2" thick—25' rolls	3/8" to 5/8", +.031", —.010" Over 5/8", ± 1/16"	Width—To 12" wide, to 3/8" incl. thick, ± 1/16" To 12" wide, over 3/8" thick, +3/32", —1/16" Length ± 5' of 25' or 50' roll	Dry**
STYLE No. 404 Giant Oil-Resisting Woven Lining Wire inserted-Unground Surface	0.20 ± .07 Running in oil	Thickness—3/8" to 1" incl. Width—2" to 12" incl.				Oil
STYLE No. 410 Giant Rotary Woven Lining Wire inserted-Unground Surface	0.45 ± .07	Thickness—1" to 1-3/16" incl. Width—2" to 12" incl.	25' rolls	1" to 1-1/8" ± 1/16" 1-3/16" +.000", —1/8"	Width—under 4" wide, ± 1/16" 4" to 6" wide, +3/32", —1/16" 6" to 12" wide, +3/16", —1/16" Length—± 5' of 25' roll	
STYLE No. 420 Giant Rotary Woven Lining Wire inserted-Unground Surface	0.45 ± .07	Thickness—3/8" to 1-1/8" incl. Width—3" to 12" incl.	25' rolls	All thicknesses ± 1/16"	Width—all thicknesses ± 1/16"	Dry
STYLE No. 430 Giant Rotary Woven Lining Wire inserted-Unground Surface	0.45 ± .07	Thickness—3/8" to 1-1/8" incl. Width—2" to 12" incl.	25' rolls	All thicknesses ± 1/16"	Length—± 5' of 25' roll	
STYLE No. 510 Ground Heavy Duty Woven Lining Wire inserted-Ground Surface	0.45 ± .07	Thickness—5/32" to 1/2" incl. Width—1" to 12" incl.	25' and 50' rolls to 3/8" x 8"; over 3/8" x 6"—25' rolls	5/32" to 1/4" incl., +.010, .015 5/16" to 1/2", +.015", —.030	Width—Under 5/16" thick, ± 1/16" 5/16" thick, +3/32", —1/16" Length—± 5' of 25' or 50' roll	Dry**
STYLE No. 600 Folded and Compressed Lining Wire inserted-Ground Surface Up to 16" wide; Unground over 16"	0.45 ± .07	Thickness—1/8" to 1" incl. Width—1" to 24" incl.	To 1/2" thick & 8 1/2" wide 25' and 50' rolls; 1/2" thick and up all widths; 8 1/2" wide & over, all thicknesses 25' Rolls only	To 1/4" thick incl.—(ground)—+.010", —.015" 5/16" thick and over—(ground) +.015", —.030 Unground (from "Asbestos" only) +.031", —.015"	Width—To 12" wide and 3/8" thick incl. ± 1/16" To 12" wide over 3/8" thick +3/32", —1/16" Over 12" wide all thicknesses ± 5/16" Length—± 5' of 25' or 50' roll	Dry
STYLE No. 900 Woven and Compressed Lining Wire inserted-Ground Surface	0.45 ± .07	Thickness—1/4" to 1/2" incl. Width—1-1/4" to 12" incl.	Up to 6" wide 25' and 50' rolls Over 6" wide, 25' Rolls only	To 1/4" thick incl.—(ground)—+.010", —.015" 5/16" thick and over—(ground)—+.015", —.030"	Width—To 3/8" incl. thick—± 1/16" Over 3/8" thick, +3/32", —1/16" Length—± 5' of 25' or 50' roll	Dry

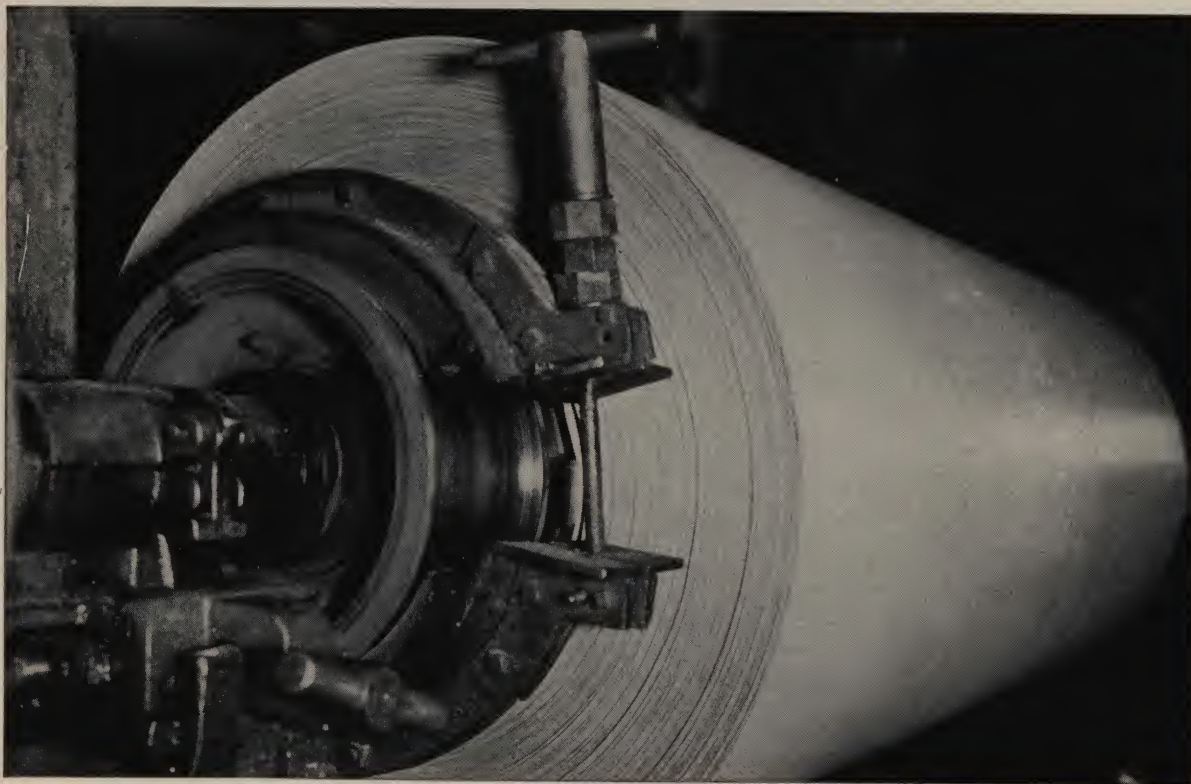
† When ordering Style Nos. 230, 232, 240 or 242 be sure to indicate whether for external or internal band.

\*\*Small amount of oil has no serious effect.





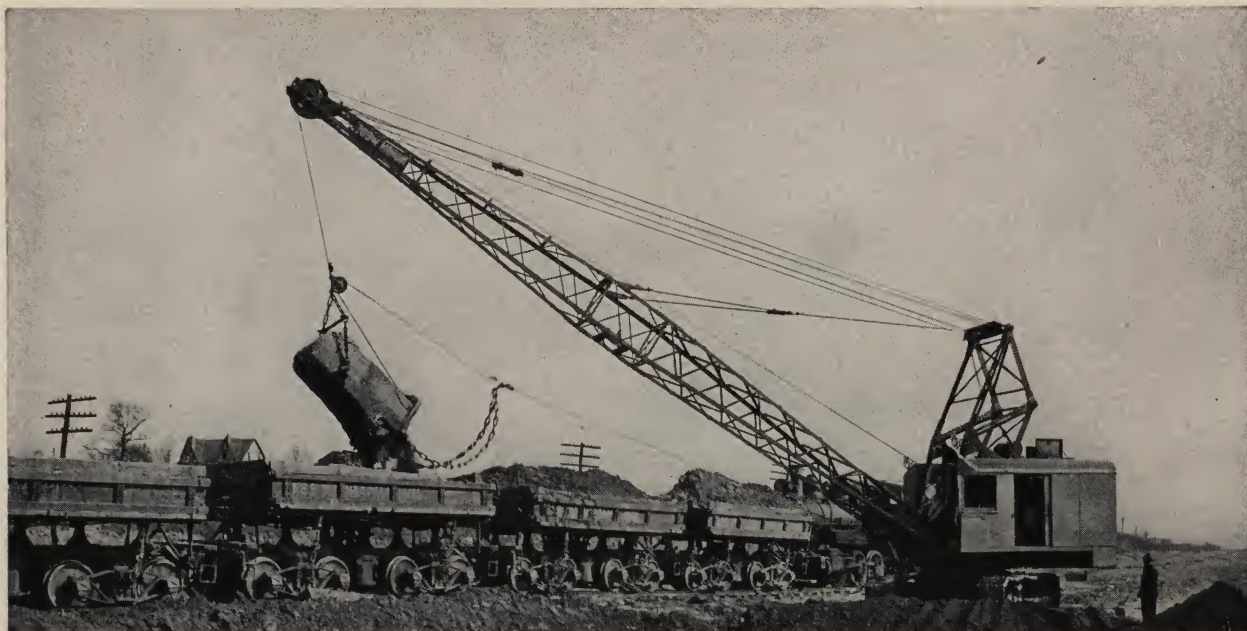
*J-M Friction Materials were used on this 260-metric ton ladle crane*



*Positive control is assured on this paper re-wind brake with J-M Friction Blocks*



## Friction Material Application



*J-M Friction Materials are used in the Special Model 80 Northwest Dragline above. It is operating on a Wabash Railroad relocation job near St. Louis*

### *Worn or Scored Drums:*

Where drums are heavily eroded or scored it is suggested that they be turned or smoothed, possibly with a grinding stone, before new linings are put on.

If it is required that a new lining be put on a scored or worn drum it is better in most cases to use a fabric or flexible type of friction material rather than the rigid or moulded type. The moulded materials are so hard they do not readily conform to irregular surfaces, with the result that the effective brake area is materially reduced and the braking efficiency lowered until the blocks are run in, which may take considerable time. Fabric linings are softer and conform more readily to irregular surfaces, with better resultant brake or clutch action.

### *Metallic Friction Surfaces:*

Cast iron, in its various forms, affords the most satisfactory friction surface. Considerable progress has been made in alloying and heat treating cast irons, so that it is now possible to secure metals with relatively high tensile strength which are more resistant to surface checking and cracking under severe service than are the plain gray irons. Asbestos friction materials erode cast iron, which usually wears evenly, with the surface polished and free from scoring.

While improvements have been made in developing

the anti-scoring properties of linings, asbestos friction materials still tend to score any plain carbon steel under normal operating conditions. The resistance to scoring becomes greater as the carbon content or hardness of the material is increased. In the field of alloy steels much useful work has been done with chrome-molybdenum steel drums. These steels seem to be highly resistant to temperature change and will stand severe service without checking or cracking.

### *Dissipation of Heat:*

Fundamentally, any clutch or brake is a mechanical device for converting mechanical energy into heat energy. Therefore, the ultimate answer to good braking or clutching operations is the satisfactory dissipation of the heat generated.

Practically all of the heat generated is absorbed by conduction into the metal mass of the brake drum. The greater the metal mass and consequent heat absorption capacity, the lesser will be the temperature resulting from any series of operations.

From the surface of the drum, the heat is dissipated by radiation and convection. To secure maximum radiating effect all surfaces should be painted black or some dark color. It is always advisable to design friction drums with as many ribs or cooling fins as possible in order to increase convection losses.





*J-M Folded and Compressed Brake Lining on a Morgan crane in a large steel plant*

### ***Fastening Material:***

Asbestos friction materials are usually fastened in position with either rivets or bolts.

Due to wear of the friction material, it is sometimes impossible to prevent occasional contact of the fastenings with the drums. Every effort must be made, therefore, to prevent the possible cutting, scoring, or wearing away of the drum by the proper selection of the fastening material.

The materials generally employed for bolts and rivets are copper, brass and aluminum, or their alloys.

Copper rivets are strong, tough and ductile and are widely used against both cast iron and steel friction surfaces. However, copper tends to drag and plate the metal surface and may cause serious erosion of the drum.

Brass rivets are superior to copper because they resist abrasion better and show no tendency to score under normal operating conditions.

As a general rule, solid flat head rivets are the most satisfactory type for industrial purposes. Semi-tubular rivets are better for this work than the full tubular kind as they are considerably stronger. Split rivets should never be used on industrial work.

The minimum length of rivet should be the thickness of lining under the rivet head plus the thickness of the brake band or shoe, plus the diameter of

the rivet body. The maximum length should be the thickness of lining under the rivet head, plus the thickness of brake band or shoe, plus the diameter of the rivet body, multiplied by 1.25. The length of a rivet is measured in sixteenths of an inch from the underside of the head to the end of the shank or body.

For fabric linings it is suggested that rivet heads be made twice the diameter of the body or shank. Moulded linings are dense and mechanically strong and do not require rivets with as large heads to hold the lining in position.

Moulded blocks, being relatively thick and of large size, are usually fastened in place with standard bolts or heavy solid rivets, as shown in Figs. 1 to 4.

Sometimes a metal insert is moulded in friction block material and a steel cap screw used as a fastener (see Fig. 5). If the hole or the cap screw is elongated so that the major axis of the hole is radial, in a clutch on which a V block is used, or across the band, in a band-type brake, it is possible to align the blocks readily by applying pressure to the brake or clutch with the bolts of the block loose. When the blocks are in proper position, the bolts are tightened.

There should be no clearance on the bolts in line with the force on the blocks, as the blocks may slip and shear the bolts. All bolts and screws should have



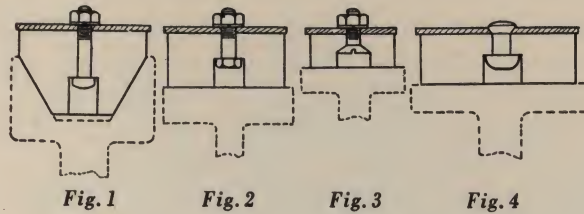


Fig. 1

Fig. 2

Fig. 3

Fig. 4

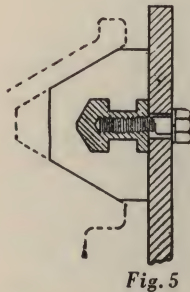


Fig. 5

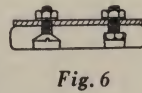


Fig. 6

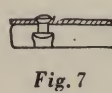


Fig. 7

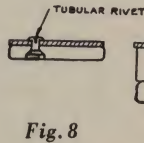


Fig. 8

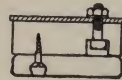


Fig. 9

heavy steel lock-washers to prevent loosening under vibration. Inserts cannot be moulded in Moulded Friction Linings, Styles No. 230, 235 and 240, as these are generally of thin section.

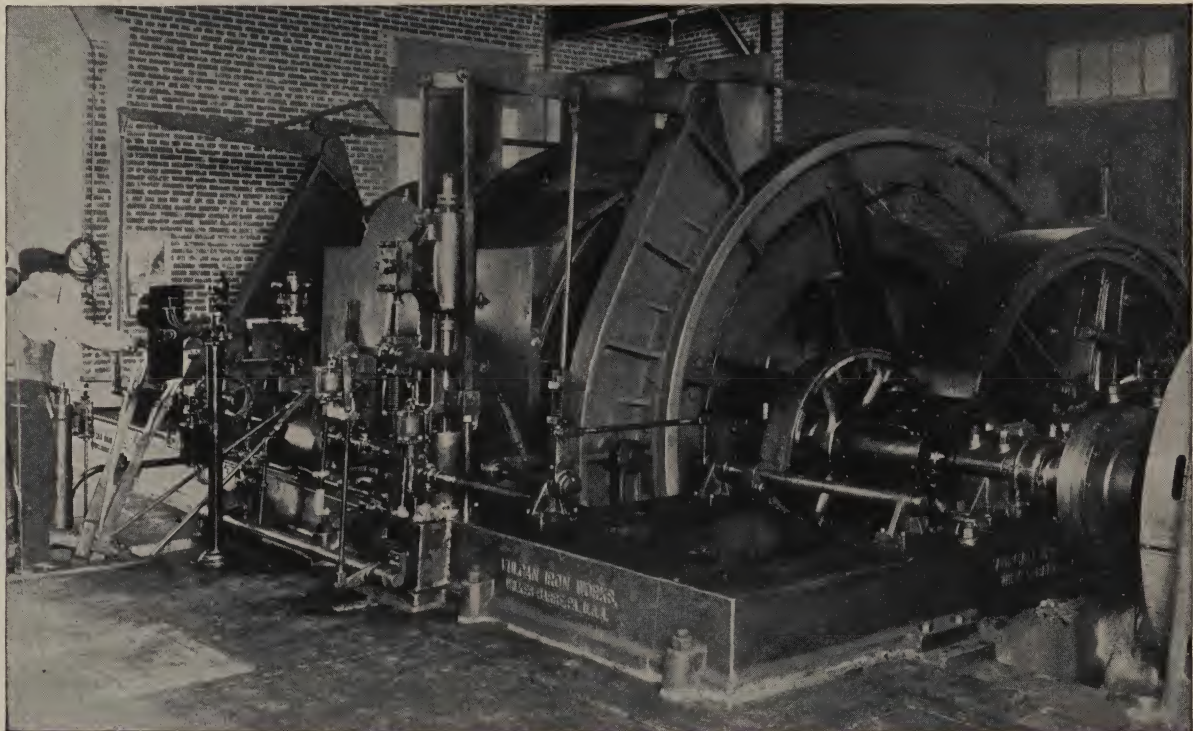
On large sized industrial linings of the flexible styles, bolts are generally employed. Linings less than  $\frac{1}{2}$ " thick are usually secured to the bands by rivets. (See Fig. 6, 7, 8 and 9.)

### Countersinking:

Fastenings of any type should never be permitted to come in contact with the brake drum or clutch plate, as they might cut or abrade it. The heads should be countersunk below the friction material surface as far as can conveniently be done without weakening the holding power of the fastening.

In flexible materials, it is customary to counterbore at least half the thickness; in rigid materials, which are much stronger physically, about two-thirds of the thickness. V-type blocks obviously do not require sinking the bolts as there is little possibility of their contact with the friction drum. Sinking the heads of fastenings in a flexible lining is sometimes accomplished merely by forcing the rivet head into the material, but this is not good practice. It is better workmanship to drill and counterbore for the fastening by removing material from lining. This is easily accomplished by standard drills and counterbores and the use of portable electric drills or drill presses. Johns-Manville Friction Blocks can be readily drilled with a wood point drill or wood bit.

Several machines are manufactured for drilling and counterboring brake lining, and rivet presses also are available for use in the automotive trade. These



*Type 600 Folded and Compressed Brake Lining is ideal for colliery hoists*

### FRICION MATERIAL APPLICATION

January, 1942 (Cancelling sheet dated September, 1939)

FR-41





*J-M Giant Woven Lining coming from the loom*

can be adapted in many cases for use on industrial braking equipment. Drilling and counterboring machines, as well as a full line of rivets, may be obtained through Johns-Manville.

### **Rivet Hole Plugs:**

Rivet-hole countersinks in friction linings have a tendency to accumulate dirt and abraded materials which increases the possibility of scoring the drums and reducing the life of the friction material.

The use of J-M Rivet Hole Plugs, Style No. 1200, largely eliminates such destructive actions resulting from countersinks as well as increasing the area of the friction material surface. The plugs are recommended for all styles of blocks and fabric linings.

After the blocks or lining have been riveted or bolted to the band or shoe, the plugs are inserted in the countersinks and driven firmly into place. It is important the plugs be ordered to exact dimensions so as to assure proper fit and to fill the countersink completely.

Any excess material which protrudes above the surface of the friction blocks or lining should be faced-off flush before placing in service.

### **Number of Fastenings Required:**

While friction materials normally require little more than contact with the band to keep them from sliding, there are times when considerable stress is brought on the fastenings, such as by a sudden vigorous application of the brake, and sufficient fastenings must be provided to prevent possible slipping

of the friction material. Practice varies considerably, due to the nature of the service and the particular material to be held in place.

The following table, based on average practice, shows allowable friction surface area per fastening:

<i>Flexible Linings</i>	<i>Fastenings</i>	<i>Area</i>
To steel bands	Light service, $\frac{1}{8}$ " to $\frac{3}{16}$ " rivets	4 sq. in.
	Medium service, $\frac{1}{4}$ " rivets	8 sq. in.
	Heavy service, $\frac{5}{16}$ " rivets	10 sq. in.
<i>Moulded Blocks</i>		
Heavy blocks	Heavy service, $\frac{3}{8}$ " to $\frac{1}{2}$ " bolts	10 sq. in.
Moulded linings to steel bands	Heavy service, $\frac{1}{4}$ " to $\frac{5}{16}$ " rivets	8 sq. in.

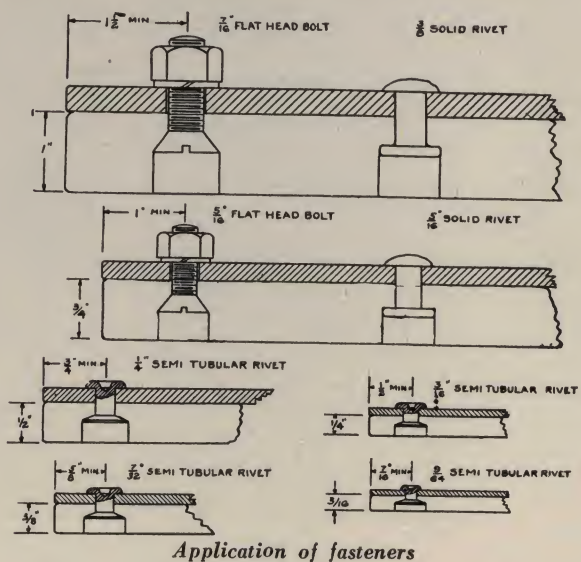
Efforts should be made to distribute fastenings proportionately over the area.

### **Replacing Fabric Facings with Moulded:**

On clutches or brakes of the disc type, it is frequently desirable to replace asbestos fabric facings with a moulded type. The fabric material is usually fastened by rivets arranged near the edge of the material, in order to hold it down against the metal. Usually, a large number of rivets are used to prevent the fabric from bulging and also to lessen the chance of its stretching at the rivet holes.

This is the correct way to fasten a flexible material like asbestos fabric but it is not the correct method of fastening a solid material such as Johns-Manville Moulded Friction Facings.

The proper method of fastening a solid material such as Moulded Friction Facings is to use about half the number of rivets required for fabric material, and keep the rivets away from the edges of the facings.









INSULATION



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*The sheets listed above are Catalog or Commodity sheets. Other currently available data sheets are listed on the reverse of this sheet.*



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## Insulation



*J-M Industrial Insulating Materials reduce operating costs and improve performance wherever heated or refrigerated equipment is used*

**I**NSULATION is used to retard heat flow where it is desired to maintain a temperature either higher or lower than that of the surroundings. Whether heating or refrigerating is involved, insulation is essential to economical operation.

### *Heated Equipment:*

While fuel saving is the principal advantage of insulation in heated equipment, and the one most readily convertible into dollars and cents, there are other attendant advantages which in many classes of work are considered to be at least as important as the saving of fuel. First among these is the improvement in product quality, or if a product is not involved directly, improvement in process control and efficiency. This is brought about by the more uniform heat distribution and more accurate temperature control possible only with insulated equipment. Insulation also serves to improve working conditions around the equipment and, in many cases, to increase capacity.

Steam pipe insulation maintains superheat or re-

duces condensation, permitting the delivery of higher quality steam, and through heat saving pays for itself several times each year.

In industrial furnaces of all types, additional advantages of insulation are protection to monolithic refractory or brick from rapid temperature changes, reducing internal strains, cracking, and spalling.

### *Refrigerated Equipment:*

From the standpoint of economical operation, insulation of low temperature equipment and structures is especially important. A ton of refrigeration, which is equivalent to the removal of 288,000 Btu per 24 hours, costs approximately ten times as much as the equivalent number of Btu when produced for heating purposes. The necessity for much heavier insulation on low temperature work than is customary for high temperatures is, therefore, immediately apparent. Furthermore, many forms of cold storage demand that temperatures be controlled within a narrow range, a condition equally common in the cold



processing of oils and chemicals. Such close temperature control cannot be maintained without adequate insulation to reduce heat transfer.

### Thickness of Heat Insulation

The economical thickness of insulation depends primarily upon the temperature and the cost of heat. Thickness is ordinarily computed on the basis of fuel costs and operating conditions so the heat which passes through the insulation is only that portion which can not be economically saved. Sometimes special conditions require thicker insulation than warranted by fuel saving alone.

The economical thickness of pipe insulation also depends on the pipe size. While it is a fact that small pipes would have to be more heavily insulated to give the same saving of heat, it is nevertheless true that the larger pipes should be provided with thicker insulation in order that the maximum net saving be realized. A 1" pipe with 1" thick insulation will lose heat more rapidly per sq ft of pipe area than a 10" pipe with the same thickness of insulation; because the outside surface of the insulation on the 1" pipe is nearly 200 percent greater than that of the pipe, while the outside area of the insulation on a 10" pipe is less than 20 percent greater. As a result of the greater area through which heat may flow, the losses from the 1" pipe must be greater.

The matter of net saving takes into account both the saving per year and the cost per year of effecting that saving. Therefore, since the insulation on a 1" pipe costs from 1½ to 3 times as much per square foot of pipe surface as on a 10", and since each inch of thickness on a 10" pipe saves more heat than the same on a 1", it is at once evident that it pays to put a thicker insulation on a 10" than on a 1" pipe.

### Selection of Insulation

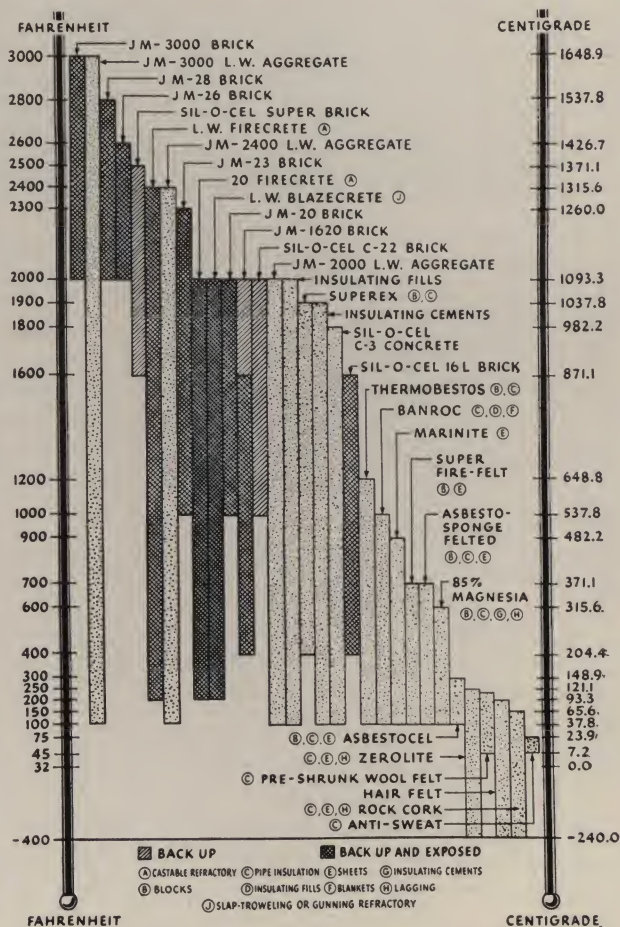
To be adaptable, insulation must be of such form as to be easily applied. It must have heat-resisting qualities sufficient to withstand successfully the highest temperatures to which it will be subjected. It must be sufficiently strong and durable to assure long life. Adaptability also depends upon many other conditions incidental to the particular application.

The insulating value of a commercial insulation depends primarily upon the small voids which it contains. In order to be most effective, the voids must be enclosed and so small that circulation within them and radia-

tion across them will be at a minimum. Small void size is particularly important at high temperatures because of the rapid increase in convection and radiation with rise in temperature.

From the five mineral products— asbestos, magnesium carbonate, diatomaceous silica, refractory clays and mineral wool—Johns-Manville furnishes insulation in the forms of sectional pipe insulation; insulating sheets, blocks, bricks and blankets; insulating cements and fills; together with accessory finishing materials in the form of cements, coatings, papers and felts.

Johns-Manville offers a complete line of insulation materials for every kind of equipment used throughout the entire range of industrial processes where temperatures vary from sub-zero to 3000 F and more. A few of these materials are shown in the chart below. The recommended temperatures are those applied to the insulation, rather than process temperatures.



*J-M Insulating Materials cover the entire range of industrial temperatures*



## J-M Brick, Sheet and Block Insulation

Insulation in the form of bricks, sheets and blocks is generally most suitable for flat or moderately curved surfaces. Brief descriptions of some of the J-M products available are given in the following paragraphs. A more complete coverage is given elsewhere on individual data sheets. All of the weights given for the products which follow are approximate.

### Bricks

J-M furnishes two types of brick: Insulating Fire Brick made from refractory clay and processed to give a uniform, controlled pore structure, designated as JM-1620, 20, 23, 26, 28 and 3000 Brick; and Insulating Brick made from diatomaceous silica, designated as Sil-O-Cel 16L, Sil-O-Cel C-22, and Sil-O-Cel Super Brick. All are furnished in standard 9" shapes of the 2½" and 3" series as well as in special shapes. J-M also supplies Insulating Fireblok, similar in composition and properties to the Insulating Fire Brick, in sizes 9" x 24" and 9" x 12", 2½" thick.

*J-M Insulating Fire Brick and Insulating Brick*

Name of Brick	Approx. wt each, lb	Cold Crushing Strength, lb/sq in.	Temp Limit, F Back-up	Temp Limit, F Exposed
JM-1620	1.7	70	2000	1600
JM-20	2.1	115	2000	2000
JM-23	2.5	170	2300	2300
JM-26	2.8	190	2600	2600
JM-28	3.4	150	2800	2800
JM-3000	3.8	400	3000	3000
Sil-O-Cel 16L	2.0	350	1600	1600
Sil-O-Cel C-22	2.2	700	2000	—
Sil-O-Cel Super	2.3	300	2500	—

### Sheets and Blocks

**Asbesto-Sponge Felted** (Temp Limit 700 F): Constructed from felts composed of asbestos fiber so combined to give a spongy laminated material. Withstands rough usage; can be removed and replaced without impairing its thermal characteristics or structural strength. Furnished 36" long by 6", 9", 12", 18", 24" and 36" wide, from 1" to 4" thick. Weight 2½ lb per sq ft, 1" thick.

**Asbestos Fire-Felt** (Temp Limit 1000 F): Except for greater mechanical strength, made and furnished like Super Fire-Felt, following. Weight varies from 3½ lb for the thinner material to 2½ lb per sq ft, 1" thick, for thicker material.

**Banroc Board** (Temp Limit 225 F): A blended mineral wool formed with a moisture-resisting binder into rigid sheets. Used in heating, ventilating and air-



*Applying 85% Magnesia Blocks to a large boiler wall*

conditioning ducts and equipment. Also for oil storage tanks, dryers and general moderate temperature service, especially where moisture prevails. Furnished, 24" x 36", in thicknesses of ½", 1", 1½" and 2" Weight 1½ lb per sq ft, 1" thick.

**Asbestocel** (Temp Limit 300 F): Manufactured of built-up layers of alternate plain and corrugated asbestos felts. Used on medium and low pressure boilers, warm air ducts, etc. Furnished with 4 and 6 plies per inch of thickness, in widths of 6", 9", 12", 18" and 36"; lengths of 36", 48", 72" and 96"; thicknesses from 2 plies to 2". Weights are 1 lb and 1.3 lb per sq ft per inch thickness respectively.

**85% Magnesia Blocks and Lagging** (Temp Limit 600 F): One of the most efficient commercial insulations. Made of hydrated basic carbonate of magnesia bonded with asbestos fiber. Flat blocks are furnished 3", 6", 9" and 12" wide by standard lengths of 18" or 36". Thickness of flat blocks, 1" to 4". The 1" thickness is made 3" and 6" wide only. Also made in curved blocks and locomotive boiler lagging. Other sizes and greater lengths on special order. Weight 1.1 lb per sq ft, 1" thick.

**Marinite-36** (Temp Limit Type A, 900 F; Type B, oil-treated, 250 F): A light-weight fireproof sheet material made of asbestos fiber with an inorganic binder. Suitable for ovens and driers, marine joiner work, heat shields, ducts and breechings, boiler-room walls and ceilings and for fire-proofing structural steel. Standard sizes are furnished 36", 42" and 48" by 96", and 48" by 120", in thicknesses of ½", ¾", 7/8" and 1". Weight 3 lb per sq ft, 1" thick.

**Rock Cork Sheets, Lagging and Discs** (Temp Range — 400 to + 150 F): A highly efficient material for refrigerating equipment. Made from mineral wool



with a waterproof binder. Sheets are 18" x 18" x 1" and 18" x 36" in 1½", 2", 3" and 4" thicknesses. Weight 1¼ lb per sq ft, 1" thick. Discs from 1½" to 4" thick up to 18" diam; in two pieces, to 36". Also in lagging form for curved surfaces.

**Super Fire-Felt** (Temp Limit 700 F unsupported or 900 F supported): Formed of asbestos fiber and a binder for use where a light, strong material is required. Furnished in sheets 24" x 36" and blocks 6" x 36", from ½" to 4" thick. Also on order in curved or special shapes for irregular surfaces. When installed between metal or brick linings, it may be used for temperatures to 900 F. Weight 2¼ lb per sq ft, 1" thick.

**Superex Blocks** (Temp Limit 1900 F): Made of specially selected diatomaceous silica, blended with other insulating materials and bonded with asbestos fiber. For insulating boiler walls, furnaces, etc. Blocks are 3", 6", 9" and 12" by 18" and 36". Thicknesses from 1" to 4" for flat blocks. The 1" thickness is made 3" and 6" wide only. Also furnished in curved blocks. Other sizes and greater lengths on special order. Weight 2 lb per sq ft, 1" thick.

**Thermobestos Blocks** (Temp Limit 1200 F): Made of hydrous calcium silicate combined with asbestos fiber. For insulating boilers, tanks, heat exchangers, etc. Blocks are 6" or 12" by 3-ft. Thicknesses from 1" to 4". Other widths up to 12" on special order. Weight one lb per sq ft, 1" thick.

**Zerolite Sheets, Lagging and Discs** (Temp Range — 400 to + 250 F): An efficient insulating and fire-resistant material for refrigerating equipment. Made from mineral wool with a resin binder. Sheets are 18" x 36" in 1½", 2", 3" and 4" thicknesses; 18" x 18" in 1" thickness. Weight 1.3 lb per sq ft, 1" thick. Discs are furnished from 1½" to 4" thick up to 18" diam; in two pieces, to 36". Also as lagging for curved surfaces.

### Blankets, Paper, Millboard

**Asbestocel—Flexible Roll Form** (Temp Limit 300 F): Made of a plain and corrugated asbestos felt, cemented together, about ¼" thick; also fine corrugated, ⅙" thick. Used for heater or furnace pipes. At least two layers should be used. Furnished 37" wide in 125 or 250 sq ft rolls.

**Asbestos Blankets** (Temp up to 850 F, depending upon type of cloth used): Flexible insulation made of asbestos cloth in envelope form, filled with asbestos fiber and tufted with wire. For irregular surfaces, such as paper digesters and steam turbines, where removable insulation is desired. Furnished to order in

1½", 2" and 2½" thicknesses in single layer and 3", 4" and 4½" thicknesses in double layer.

**Asbestos Paper and Roll Board:** Used where insulation of minimum thickness is required, principally as a protection against heat and as a fire-retardant. Paper is furnished 18", 24", 36", 37½", and 72" wide in thicknesses from 0.015" to ⅙". Roll Board (heavy asbestos paper) is furnished 18", 36" and 72" wide in ⅜" and ⅛" thicknesses. Both are supplied in standard rolls of 25, 50 or 100 lb. Special widths and cut sheets on order. A 12-lb Asbestos Paper Tape is available in rolls 84 ft long and 2" and 3" wide.

**Asbestos Sheet Millboard:** Recommended where relatively thin sheets or boards are required for protection against fire, heat, and acid fumes. Used as a fire-resistant lining for partitions, etc. Also used in ranges, stoves, etc. Made in various grades and heat-resisting properties. Furnished ⅜" to ½" thick in standard sheets 42" x 48" or in cut pieces.

**Asbestos Roll Fire-Felt** (Temp Limit 1000 F): A soft, flexible asbestos felt that may be folded, bent or wrapped around pipes and heated surfaces. Furnished in 100-sq ft rolls, 36" wide, ⅜" to ¼" thick.

**Banroc Blankets** (Temp Limit 1000 F under normal conditions): A flexible insulation used for baking ovens, dryers, etc. Composed of Banroc (mineral wool) felted and secured between galvanized wire mesh, expanded lath, stucco lath, rib lath, or fly-screen wire. Also furnished with asbestos paper both sides. Standard sizes for most types of Banroc blankets are 24" x 96" and 24" x 48", from 1" to 6" thick.

**Standard Hair Felt** (Temp Limit 200 F): Made from 100% cattle hair and widely useful at low or moderate temperatures. Furnished from ¼" to 2" thick in bales 3, 4½, 6 and 9-ft by 50-ft long.

**Thermoflex Blankets** (Temperature limit, depending upon construction): An insulation made of lightweight refractory fiber felt sealed between metal foils (flexible or preformed) or inclosed in varied screens or meshes to conform to required shape. For jet engines, exhaust assembly components and ice-elimination systems in all types of aircraft; also guided missiles; exhaust manifolds and similar equipment. Custom made in four basic types.

**Thermoflex Tape** (Temperature limit, depending upon construction): Made of asbestos fiber inclosed in knitted Inconel mesh for the insulation of diesel engine exhaust manifolds and as expansion joint filler in refractory settings. Furnished 1¾" wide, 1" thick, 25 ft or more long.



## Sil-O-Cel Insulating Brick

Johns-Manville manufactures three types of Sil-O-Cel\* Insulating Brick: Sil-O-Cel Super Brick and Sil-O-Cel C-22 Brick for use behind refractory linings only, and Sil-O-Cel 16L Brick for both back-up and direct exposure. All are particularly useful where high load-bearing characteristics are required. The new Sil-O-Cel 16L is an improved replacement for the former Sil-O-Cel Natural Brick. All are used in boilers, stills, heat-treating furnaces, kilns, lehrs, flues, retorts, stacks and other types of high temperature equipment. Their maximum service temperatures and types of bonding mortars are given below. Complete properties are shown in a following table.

Type of Brick	Max Service Temp, F	Mortars used and approx. lb per 1000 Brick			
		Back-up	lb	Exposed	lb
Sil-O-Cel Super	2500	Super Brick	80	—	—
Sil-O-Cel C-22	2000	Sil-O-Cel	80	—	—
Sil-O-Cel 16L	1600	Sil-O-Cel	80	J-M 1626 Cement	200-400

The mortars used for laying the Sil-O-Cel brick possess high insulating properties to assure a wall of practically the same insulating value throughout.

All types of Sil-O-Cel brick are furnished in the standard 9" shapes of the 2½" and 3" series, as well as special shapes.

### Sil-O-Cel 16L Brick

*For temperatures to 1600 F*

Sil-O-Cel 16L Brick are made from diatomaceous silica, molded and calcined. They serve for temperatures to 1600 F, back-up or *exposed*. This type of Sil-O-Cel brick is one of the most efficient insulating brick obtainable and is used in preference to other types of Sil-O-Cel Brick except where severe temperatures are encountered.

Sil-O-Cel 16L Brick have a cold crushing strength of approximately 350 psi, and so are amply strong for structural purposes. Owing to the extremely low reversible thermal expansion, less than 0.1 at 1600 F, Sil-O-Cel 16L Brick are particularly advantageous in building long-lasting refractory masonry. Because of this valuable property, 16L brick can also be bonded for direct exposure.

Sil-O-Cel 16L Brick are furnished so that accurate, smooth surfaces are assured. This enables the brick to

\* Reg. U. S. Pat. Off.



"Core wall" of Sil-O-Cel Brick in down-draft brick kiln for firing refractories

be laid up with thin joints and permits bonding with the fire brick where required.

### Sil-O-Cel C-22 Brick

*For temperatures to 2000 F*

Sil-O-Cel Brick are an efficient, diatomaceous silica brick, molded and calcined for use as a back-up insulation behind fire brick or behind insulating fire brick where the temperature on the insulation will not exceed 2000 F.

In preventing transmitted heat loss, C-22 Brick are three to four times as effective as fire brick in retarding heat flow through furnace walls. In other characteristics, they combine, to a remarkable degree, all those qualities desirable in an ideal, general-purpose insulating brick.

Sil-O-Cel C-22 Brick have a cold crushing strength of about 700 psi, equivalent to over 50 tons per sq ft. They are therefore especially recommended for locations where high load-bearing properties are essential. While this strength is ample for structural purposes, C-22 Brick should not be used as headers in bonding walls except where they are used as a veneer.





Outside wall of Cross Cracking Unit being insulated with  $4\frac{1}{2}$ " of Sil-O-Cel C-22 Brick in "core wall" construction

Sil-O-Cel C-22 Brick are furnished true to size within the limits prescribed for No. 1 fire brick. This makes possible correct bonding with the fire brick.

In addition to its other uses Sil-O-Cel C-22 Brick are often used as the outside course in the combustion zone and first pass of water-tube boilers. They

are also used as a combination insulating and face brick course on the outside of bake ovens and similar equipment where an exterior wall of pleasing appearance and wear-resisting properties is desired.

### Sil-O-Cel Super Brick

*For temperatures to 2500 F*

Sil-O-Cel Super Brick are a calcined type of Sil-O-Cel brick designed for exceptionally severe insulating service where subjected to temperatures behind the refractory in excess of 2000 F. The Super Brick can be used where they will come in contact with temperatures up to 2500 F.

These brick have a cold crushing strength of approximately 300 psi, equivalent to over 21 tons per sq ft. While this is ample for structural purposes, they should not be used as headers in bonding walls, except where they are used in veneer wall construction.

In many cases it is possible to cut down on the thickness of first-quality fire brick when Sil-O-Cel Super Brick are used. For instance, in equipment where Sil-O-Cel 16L Brick would be used behind  $13\frac{1}{2}$ " of fire brick, Sil-O-Cel Super Brick could be safely used back of 9", or in some cases as low as  $4\frac{1}{2}$ " of refractory, introducing a considerable saving.

### Properties of Sil-O-Cel Insulating Brick

	16L*	C-22	Super
Densities, lb per cu ft. ....	33-35	38	40
Transverse Strengths, psi ....	60	115	90
Cold Crushing Strengths, psi ....	350	700	300
Linear Shrinkage, percent ....	0.7 at 1600 F	0.8 at 2000 F	2.0 at 2500 F
Reversible Thermal Expansion, percent..	Less than 0.1 at 1600 F	0.7 at 2000 F	1.3 at 2000 F
Conductivity (Btu in. per sq ft per F per hour at indicated mean temperatures)	0.95 at 600 F 1.01 at 800 F 1.07 at 1000 F 1.13 at 1200 F	1.67 at 500 F 1.88 at 1000 F 2.08 at 1500 F	1.70 at 500 F 1.95 at 1000 F 2.19 at 1500 F 2.45 at 2000 F
Recommended Service			
Back-up .....	1600 F	2000 F	2500 F
Exposed .....	1600 F	—	—

\* Properties given for this brick are approximate.



## J-M Insulating Fire Brick and Fireblok

J-M Insulating Fire Brick and J-M Insulating Fireblok are produced from a high quality refractory clay and a carefully graded organic filler, which upon being burned out during the manufacturing process gives a uniform, controlled pore structure to the finished product. The material is moulded, fired and then accurately ground to size.

The brick and Fireblok, owing to their light weight and high insulating value, make possible thinner furnace walls, improved efficiency and lower operating costs.

The six types of brick and Fireblok with their respective temperature limits are identified in the following paragraphs. The weights given are approximate.

### JM-1620 Insulating Fire Brick

*For temperatures to 1600 F, exposed  
(to 2000 F, back up)*

JM-1620 Insulating Fire Brick, 1.7 lb per brick, are recommended for use as a direct refractory lining for temperatures not over 1600 F, and for service behind fire brick or other insulating fire brick where the temperature on the JM-1620 brick will not exceed 2000 F.

They are used in such equipment as core ovens, hot blast mains, producer gas mains, regenerators, recuperators, stress-relieving furnaces and similar equipment.

### JM-20 Insulating Fire Brick

*For temperatures to 2000 F*

JM-20 Insulating Fire Brick, owing to their light weight, 2.1 lb per brick, and high insulating value, are used in annealing ovens and various other types of equipment where the use of an insulating refractory of low density, low heat capacity and low conductivity is required. The brick are also used as insulating refractories behind fire brick or other insulating fire brick on such equipment as carbonizing furnaces, lehrs, normalizing furnaces, oil stills and heaters, and for stack linings, where the temperature on the JM-20 brick will not exceed 2000 F.

### JM-23 Insulating Fire Brick

*For temperatures to 2300 F*

JM-23 Insulating Fire Brick, 2.5 lb per brick, possess the low heat capacity and high spalling resistance which adapts them exceptionally well for service as insulating fire brick or insulation behind refractory protection in such equipment as drawing furnaces, electric furnaces, and hardening furnaces, where the temperature on the JM-23 brick will not exceed 2300 F.



*This furnace wall construction consists of 13½" of JM-23 Insulating Fire Brick backed up by Superex and 85% Magnesia combination*

### JM-26 Insulating Fire Brick

*For temperatures to 2600 F*

JM-26 Insulating Fire Brick combine high spalling resistance and light weight (2.8 lb per brick). They are suitable for use as an insulating fire brick or back-up insulation in calciners, ceramic kilns, heat-treating furnaces and similar equipment where the temperature on the JM-26 brick does not exceed 2600 F.

### JM-28 Insulating Fire Brick

*For temperatures to 2800 F*

JM-28 Insulating Fire Brick, with the comparatively light weight of 3.4 lb per brick and high spalling resistance, are used as insulating fire brick or back-up insulation in enameling furnaces, soaking-pit covers, ceramic kilns and other locations where JM-28 brick will not be subjected to temperatures above 2800 F.

### JM-3000 Insulating Fire Brick

*For temperatures to 3000 F*

JM-3000 Insulating Fire Brick, 3.8 lb per brick, is the highest temperature insulating fire brick made for back-up or exposed use, effectively withstanding the full 3000 F. The brick are especially adaptable for use in forge furnaces, ceramic kilns, chemical process furnaces and other types of high-temperature equipment operating above the previous range of insulating fire brick. Also, JM-3000 brick has exceptional service advantages in many operations at lower temperatures where regular or special fire brick is ordinarily used.



### J-M Insulating Fireblok For temperatures to 3000 F

J-M Insulating Fireblok, similar in composition and properties to J-M Insulating Fire Brick, has many advantages over the small sized fire brick from both a construction and stability standpoint.

The Fireblok are supplied in standard sizes of 9" x 24" and 9" x 12", 2½" thick.

The large, convenient sizes and light weight of Fireblok assure fast, economical installations. Also, the number and length of joints are materially reduced, resulting in a more efficient construction thermally. With reduced joint length, the Fireblok require a minimum of mortar for bonding.

Fireblok can be cut with a saw and shaped with a rasp easily. Most special shapes can be either shop or field cut from standard slabs, enabling a reduction in the inventory of special shapes.

The Fireblok are particularly suitable for the lining of doors, for the construction of laboratory and tool room furnaces. When Fireblok are tapered, sprung arches of exceptional stability can be constructed.

### Sizes, Shapes and Accessories

J-M Insulating Fire Brick are furnished in standard fire brick size, 9" x 4½" x 2½", and in standard and special shapes as ordered. They are packed in fiber cartons containing twenty 9" straight brick or an equivalent volume of other sizes. The various standard shapes available include the following:

2" brick	No. 1, 2 and 3 arch	side skew
3" brick	No. 1, 2, 3 and 4 key	No. 1, 2 and 3 neck
feather edge	edge skew	circle, splits, soaps
No. 1, 2 and 3 wedge	end skew	chamfered

For laying the brick as a back-up insulation, J-M Insulating Fire Brick Mortar is used. The quantity required is approximately 200 lb per thousand brick.

When J-M Insulating Fire Brick are used as an insulating refractory, J-M Special Bonding Mortar is used for JM-3000; J-M No. 2986 Mortar for JM-28; and J-M No. 1626 Cement for the other brick (JM-1620, 20, 23 and 26). Quantities required for bonding 1000 brick are as follows: 400 lb for No. 2986 and Special Bonding Mortar; 200 lb for No. 1626.

The same mortar and cement are used for Fireblok as for the Insulating Fire Brick.

## Properties of J-M Insulating Fire Brick and Fireblok

The temperature limits given for back-up insulation refer to the actual temperature on the hot face of the insulation, not the maximum operating temperature of the furnace. A brick having a temperature limit of

2000 F may be used as a back-up in furnaces operating at temperatures over 2000 F due to the temperature drop through the refractory lining.

The table below gives the physical properties.

	JM-1620	JM-20	JM-23	JM-26	JM-28	JM-3000
Densities, lb per cu ft . . . . .	29	35	42	48	58	63-67
Transverse Strengths, psi . . . . .	60	80	120	125	120	200
Cold Crushing Strengths, psi . . . . .	70	115	170	190	150	400
Linear Shrinkage,† percent . . . . .	0.0 at 2000 F	0.0 at 2000 F	0.3 at 2300 F	1.0 at 2600 F	4.0 at 2800 F	0.8 at 3000 F
Reversible Thermal Expansion, percent.	0.5—0.6 at 2000 F	0.5—0.6 at 2000 F	0.5—0.6 at 2000 F	0.5—0.6 at 2000 F	0.5—0.6 at 2000 F	0.5—0.6 at 2000 F
<b>Conductivity* at Mean Temperatures</b>						
500 F . . . . .	0.77	0.97	1.51	1.92	2.00	3.10
1000 F . . . . .	1.02	1.22	1.91	2.22	2.50	3.20
1500 F . . . . .	1.27	1.47	2.31	2.52	3.00	3.35
2000 F . . . . .	—	—	2.70	2.82	3.50	3.60
<b>Recommended Service</b>						
Back up . . . . .	2000 F	2000 F	2300 F	2600 F	2800 F	3000 F
Exposed . . . . .	1600 F	2000 F	2300 F	2600 F	2800 F	3000 F

† 24-hr simulative service panel test for JM-3000; 24-hr soaking period for other brick.

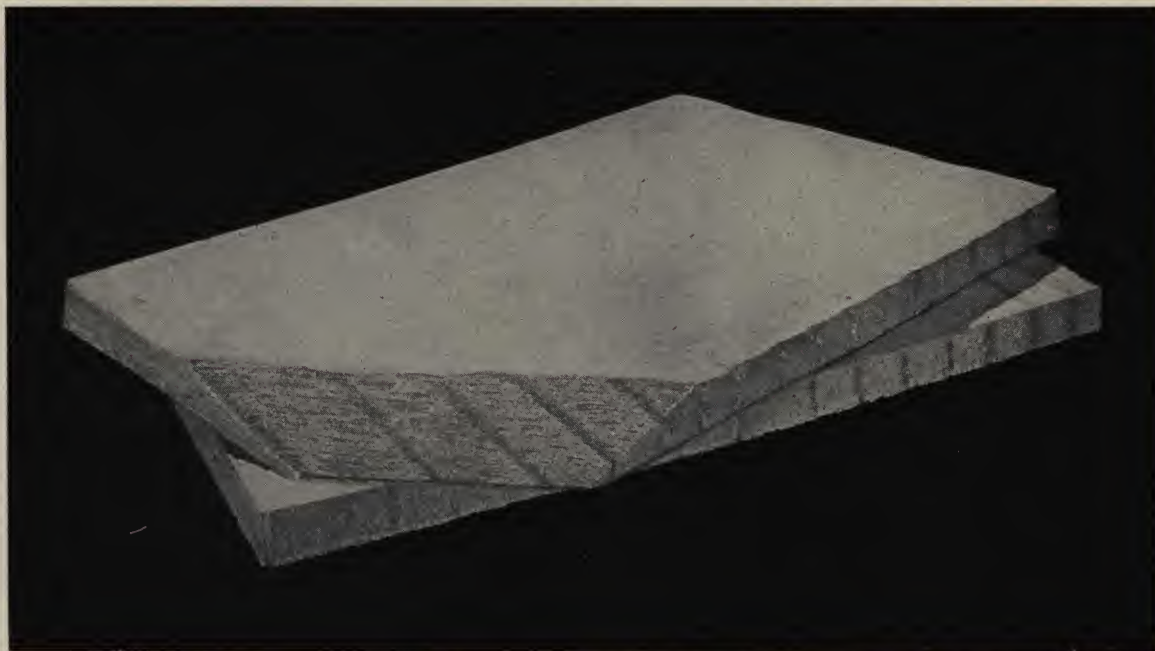
\* Conductivity is expressed in Btu in. per sq ft per F per hour at the designated mean temperatures.

Note: Above tests are in accordance with A.S.T.M. tentative standards.



# Asbesto-Sponge Felted Sheets and Blocks

*For temperatures to 700 F*



Asbesto-Sponge\* Felted sheets and blocks are a highly efficient insulating material for application to surfaces with temperatures up to 700 F, especially where severe service conditions prevail.

The principal advantages of this material over other types of insulation lie in its high insulating value and durability in service. Vibration and shock have little effect upon Asbesto-Sponge Felted; soaking it in water and then drying it out again leaves the material unchanged in structure and insulating efficiency.



*Asbesto-Sponge Felted, deformed to show laminations*

Constructed from felts composed of asbestos fiber so combined to give a spongy laminated material,

Asbesto-Sponge Felted is built up to the required thickness in laminations, cemented together at intervals and averaging approximately 40 layers per inch of thickness. The great number of surface resistances offered by such a construction provides the high insulating value found in this material.

The felted nature of Asbesto-Sponge Felted affords it considerable toughness. Consequently, rough usage does not cause breaking, crumbling or loss of efficiency.

This material, being very resistant to handling and the various forms of deterioration, can be removed and replaced without impairing its thermal characteristics or structural strength.

The weight of Asbesto-Sponge Felted is approximately 2½ lb per sq ft, per inch thickness. It is furnished 36" long by 6", 9", 12", 18", 24" and 36" wide, from ½" to 4" thick.

J-M Asbesto-Sponge Felted material is also furnished in the form of pipe insulation as described on another data sheet.

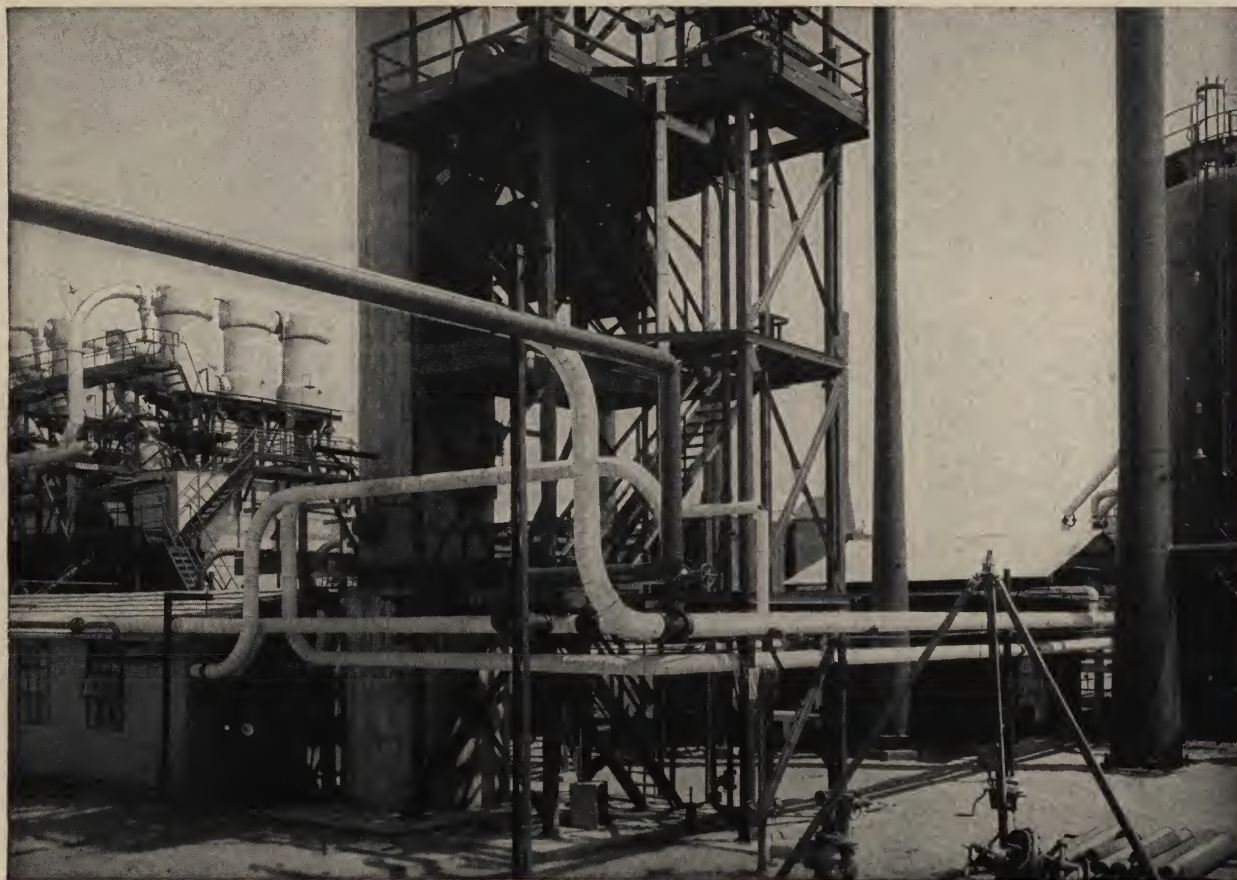
\* Reg. U. S. Pat. Off.



*Asbesto-Sponge Felted Sheets and Blocks Heat Losses*

Expressed in Btu per square foot per hour

Insulation thickness, inches	100	150	200	250	Temperature of surface—F			450	500	550	600
	25	75	125	175	Temperature difference between surface and air—F			375	425	475	525
1 .....	8.00	25.0	43.3	62.8	83.7	106	129	155	181	209	239
1½ .....	5.65	17.6	30.5	44.3	59.2	74.8	91.3	109	128	147	167
2 .....	4.35	13.6	23.5	34.1	45.5	57.5	70.2	83.6	97.8	113	128
2½ .....	3.58	11.1	19.3	27.8	37.1	47.0	57.2	68.3	79.9	92.2	105
3 .....	3.03	9.45	16.3	23.6	31.5	39.6	48.4	57.8	67.6	77.9	88.7
3½ .....	2.60	8.18	14.1	20.5	27.2	34.4	41.9	50.3	58.7	67.5	76.7
4 .....	2.28	7.13	12.4	17.9	23.9	30.3	36.7	43.9	51.4	59.4	67.2



*Where insulation must withstand mechanical abuse or other severe service, as in the refinery,  
Asbsto-Sponge Felted is especially adaptable*



# J-M Water-Resistant Magnesia

*For temperatures to 450 F*

J-M Water-Resistant Magnesia is a new development in molded insulations in which special water-repellent agents are integrally combined with J-M 85% Magnesia during the process of manufacture. It is available in both pipe and block insulation forms for application to heated surfaces at temperatures to 450F.

This product adds unique water-repellent properties to the permanence, high insulating value and excellent workability of J-M 85% Magnesia. It is designed to function under wet conditions that prevent the use of other available insulations. As demonstrated by rigorous testing, Water-Resistant Magnesia is the best material available to withstand the shock of sudden flooding of underground piping carrying steam.

## Flooding Test

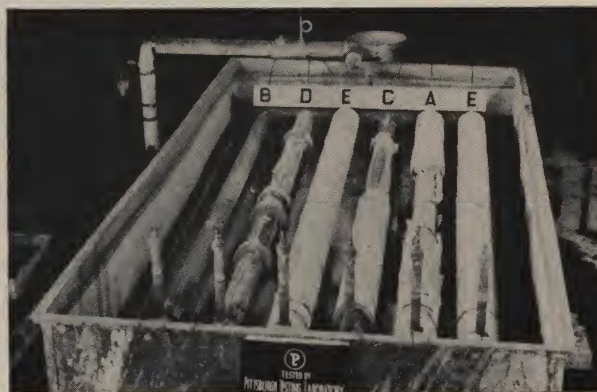
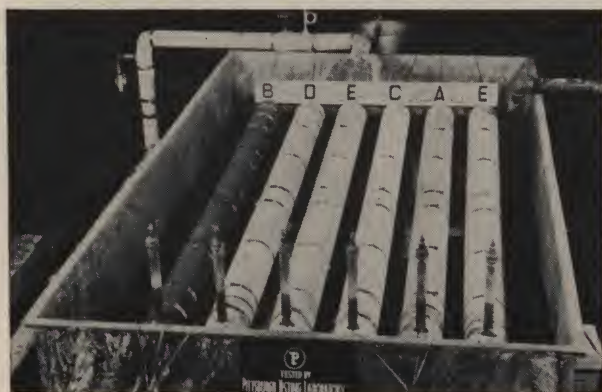
To determine the relative resistance to deterioration of Water-Resistant Magnesia and other available types of thermal insulation normally used under conditions such as are found in underground installations subject to flooding, the Pittsburgh Testing Laboratory was engaged to conduct comparative tests. Test equipment consisted of a 5-ft x 10-ft x 20-in. deep tank equipped with water supply and drain lines. Suspended within the tank were six 3" test pipes, each 8-ft long, connected to a 125 to 140 psig steam supply. Insulation, nominally 1" thick, was secured to the test pipes with metal bands. Three bands were used on each 36"-long section, one in the center and one 3" from each end; two bands were used on 18"-long sections, 3" from each end. Insulation sections were installed with all



*Illustrating the violence of the boiling water, maintained during the immersion period*

longitudinal joints in a horizontal plane; no protective jacketing of any kind was used. Five different types of thermal insulations were tested, with Water-Resistant Magnesia designated as "E".

During the entire test, steam at 125 to 140 psig passed through the insulated pipes. Boiling water was added to the tank to a level 2" above the top of the insulation and maintained at that level throughout the boiling period. After 7 hours of boiling, the tank was drained and the insulation permitted to dry for 17 hours with the steam at full line pressure. Thus one cycle of boiling and drying was completed every 24 hours. After completion of 30 such cycles, the insulation samples were subjected to an entire week of continuous boiling followed by a full day of drying. After a total of 38 days of the severest treatment, the test ended.



*Left (Before Flooding Test)—General view of insulations on test pipes. . . . Right (After Flooding Test)—Water-Resistant Magnesia was the only insulation intact. Its surfaces were roughened but the joints were firm and in good condition; bands showed no signs of cutting in. All the other insulations were in various stages of disintegration*



## Applications

The outlined test demonstrates that J-M Water-Resistant Magnesia will withstand the severest flooding and moisture conditions without a protective jacket. Its use without a jacket is recommended in conduits, tunnels, basements or other areas not accessible or subject to external abuse and where appearance is not of importance. This results in a substantial saving in jacketing cost and labor of application.

The water-repellent qualities and unimpaired strength when subject to wetting, recommend Water-Resistant Magnesia for use on short straight runs (under 100 ft) of heated piping (3" and under) laid directly in the ground. Thus the engineer can specify this material, without the expense of a conduit, for short connecting lines between buildings and for laterals running from conduits or tunnels to buildings and other structures. Water-Resistant Magnesia can also be specified on the supply lines of heating steam and hot water piping laid in the fill beneath the slab of basementless buildings. For the foregoing applications, ground conditions should be such as to permit normal drainage and the piping located above the peak water table level. Also, the Water-Resistant Magnesia should be provided with a Double Coated Flexstone jacket as a protection against stones and movement within the ground, with all jacket laps sealed to prevent infiltration of water, especially during shutdown periods.

On outdoor work where it is costly during construction to protect the insulation against rain and for exposed indoor locations where wet or severe moisture conditions are prevalent, its water-repellent qualities make this material of great value.

## Sizes, Accessories and Packaging

J-M Water-Resistant Magnesia is furnished in standard 6" x 36" blocks in thicknesses of 1" through 3" and in pipe insulation in accordance with Simplified Thicknesses in 3-ft lengths to fit standard pipe sizes. Sectional pipe insulation through 11" pipe size is regularly furnished with canvas jacket or kraft-paper wrapped, as specified. All sizes are packaged in cartons designed to meet standard handling and shipping requirements.

## Physical and Thermal Properties\*

Density, lb per cu ft .....	13
Transverse Strength (Modulus of Rupture), psi .....	50
Compressive Strength (to produce 5% compression), psi .....	70
Maximum Service Temperature, F .....	450
Conductivity, Btu in. per sq ft per F per hr at mean temperature	
<div><div>100 F</div><div>0.42</div></div>	<div><div>200 F</div><div>0.45</div></div>
	<div><div>300 F</div><div>0.48</div></div>

\* The figures given are average values obtained in accordance with accepted test methods.

## Recommended Thicknesses

The recommended thicknesses of pipe and block insulation following are optimum thicknesses calculated on an *economic* basis for heat conservation under average operating conditions and assure adequate temperature control. Unusual conditions may warrant the use of other thicknesses.

Nominal Pipe Size, Inches	Temperature of Heated Surface, F			
	100-199	200-299	300-399	400-450
	Nominal Thickness, Inches			
1½ & under	1	1	1	1½
2	1	1	1½	1½
2½	1	1	1½	1½
3	1	1	1½	2
3½	1	1½	1½	2
4	1	1½	1½	2
4½	1	1½	2	2
5	1	1½	2	2
6	1	1½	2	2
7	1½	1½	2	2½
8	1½	1½	2	2½
9	1½	1½	2	2½
10	1½	2	2½	2½
11	1½	2	2½	2½
12	1½	2	2½	3
14 & over	1½	2	2½	3
Flat surfaces	1½	2	2½	3

## Heat Transmission

For tables of heat transmission, see data sheets on J-M 85% Magnesia Block and Pipe Insulation.



## J-M Water-Resistant Magnesia Specifications

### 1. For conduits, tunnels, basements or other areas not accessible or subject to external abuse and where appearance is not of importance:

J-M Water-Resistant Magnesia pipe insulation shall be applied with joints tightly butted and each section secured with not less than three machine tightened  $\frac{1}{2}$ " x 0.020" corrosion-resistant metal bands and clips, one placed at the center and one, 3" from each end.

Pipe bends, valves, flanges and fittings of 4" pipe size and larger shall be insulated with sectional pipe or block insulation of the same thickness, cut to fit, and tightly wired in place with loops of No.18 W & M gage galvanized annealed steel wire. The insulation shall be primed with Insulkote Primer S and a 1" x No.20 W & M gage galvanized hexagonal mesh securely wired in place. A  $\frac{1}{8}$ " coat of Insulkote ST shall be troweled over the reinforcing mesh. On pipes smaller than 4", insulation shall be J-M No.301 Cement finished with a  $\frac{1}{8}$ " troweled coat of Insulkote ST.

For areas subject to flooding where a jacket is desired, the following may be specified:

J-M Water-Resistant Magnesia pipe insulation shall be applied with joints tightly butted and each section secured with not less than 3 loops of No.18 W & M gage galvanized annealed steel wire, followed by a J-M No.50 Asbestos Waterproofing Felt (Perforated). All joints shall be lapped  $1\frac{1}{2}$ ", not sealed, with longitudinal lap placed on top of the pipe. The jacket shall be secured with loops of No.16 AWG Copperweld wire applied on not greater than 4" centers or  $\frac{1}{2}$ " x 0.020" corrosion-resistant metal bands and clips applied on not greater than 6" centers, with one loop on each end lap.

Insulation and finish on pipe bends, valves, flanges and fittings shall be as specified above except that they shall be carried a sufficient distance over the adjoining pipe to permit the jacket to overlap 4".

### 2. For short straight runs (under 100 ft) of heated piping (3" and under) laid directly in the ground. (Ground conditions should be such as to permit normal drainage and the piping located above the peak water table level):

J-M Water-Resistant Magnesia pipe insulation shall be applied with joints tightly butted and each section secured with not less than 3 loops of No.18 W & M gage galvanized annealed steel wire, followed by a Double Coated Flexstone jacket. All joints shall be lapped at least 3" and sealed with Laptite. The longitudinal joint shall be placed at the side of the pipe and lapped down-

ward. The jacket shall be secured with loops of  $\frac{1}{2}$ " x 0.020" corrosion-resistant metal bands and clips applied on not greater than 6" centers, with one loop on each end lap.

### 3. For outdoor locations or exposed indoor locations where wet or severe moisture conditions are prevalent:

J-M Water-Resistant Magnesia pipe insulation shall be applied with joints tightly butted and each section secured with not less than 3 loops of No.18 W & M gage galvanized annealed steel wire. Indoors, the pipe insulation shall be finished with J-M No.3767 Asbestos & Glass Cloth, cemented with Arabol Lagging Adhesive 60-89-05, Foster Lagfas 81-42W, Stein & Hall Filmgrip No.1, or equal, over a layer of Doublex Asbestos Paper; 8-oz canvas cemented over a layer of 40-lb rosin-sized paper; or 6-oz canvas cemented directly over the insulation. Outdoors, the pipe insulation shall be finished with a Double Coated Flexstone jacket. All joints shall be lapped at least 3", horizontal joints lapping downward to shed water. Longitudinal laps on vertical pipe shall be sealed with Laptite. All other joints shall be left unsealed. The jacket shall be secured with loops of No.16 AWG Copperweld wire applied on not greater than 4" centers or  $\frac{1}{2}$ " x 0.015" corrosion-resistant metal bands and clips applied on not greater than 6" centers, with one loop on each end lap.

Pipe bends, valves, flanges and fittings of 4" pipe size and larger shall be insulated with sectional pipe or block insulation of the same thickness, cut to fit, and tightly wired in place with loops of No.18 W & M gage galvanized annealed steel wire. Indoors, the insulation shall be primed with Insulkote Primer S followed immediately by a filling and smoothing coat of J-M No.301 Cement. J-M No.3767 Asbestos & Glass Cloth or 8 or 6-oz canvas shall be cemented directly over the No.301 Cement. Outdoors, a 1" x No.20 W & M gage galvanized hexagonal mesh shall be securely wired over the insulation. A coat of Insulkote Primer E shall be applied followed immediately by a  $\frac{1}{4}$ " (wet) troweled coat of Insulkote ET.

On pipes smaller than 4", insulation shall be J-M No.301 Cement finished indoors with J-M No.3767 Asbestos & Glass Cloth or 8 or 6-oz canvas cemented directly over the No.301 Cement and finished outdoors with a  $\frac{1}{4}$ " (wet) troweled coat of Insulkote ET.

Outdoors, the insulation and finish on pipe bends, valves, flanges and fittings shall be carried a sufficient distance over the adjoining pipe to permit the jacket to overlap 4".







# J-M 85% Magnesia Blocks and Lagging

*For temperatures to 600 F*

J-M 85% Magnesia blocks and lagging are used to insulate flat, curved or irregular surfaces for temperatures to 600 F.

This material is particularly adapted to conditions where high insulating value and light weight are needed or where surfaces are so irregular that an easily cut insulation is required for proper fitting. It is composed of hydrated basic carbonate of magnesia bonded with asbestos fiber, moulded and machined into block form.

Where temperatures exceed 600 F, J-M 85% Magnesia is used over a layer of Superex, a material with higher temperature resistance. Such a construction is known as Superex Combination Insulation and is further described in conjunction with Superex Blocks.

The weight of J-M 85% Magnesia is approximately 1.1 lb per sq ft per inch thickness. It is furnished in flat blocks 3", 6", 9", and 12" wide and in standard lengths of 18" and 36". Available thicknesses and maximum lengths obtainable are shown in the table and tabular notes.

Curved blocks are furnished in the sizes and thick-



*J-M 85% Magnesia is particularly adapted to conditions where high insulating value and light weight are needed*

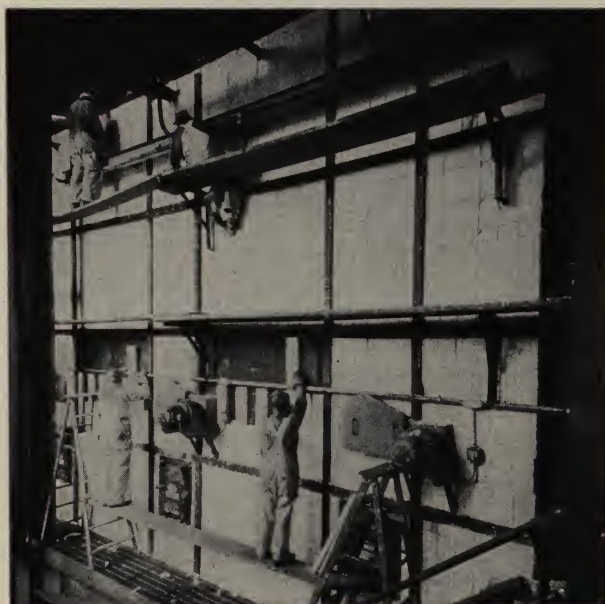
nesses indicated in the table. In the 4" thickness, curved blocks are furnished subject to the specific radius required. The radius of curvature which the blocks must fit should be specified on the order.

J-M 85% Magnesia is also furnished in pipe insulation form as described on another data sheet.

## Number of 85% Magnesia blocks per carton

Insulation Thickness, inches	Flat Blocks								Curved Blocks		
	6" x 36"			9" x 36"		12" x 36"			6" x 36"		
	M	W	R	M	W	M	W		M	W	R
1	36	36	36	—	—	—	—		36	—	36
1¼	28	28	28	—	—	—	—		28	28	28
1½	24	24	24	18	16	12	12		26	24	24
1¾	20	20	20	15	14	10	10		20	20	20
2	18	18	18	12	12	9	9		18	18	18
2¼	16	16	16	9	10	8	8		16	16	16
2½	14	14	14	9	10	7	7		14	14	14
2¾	12	12	12	9	8	6	6		12	12	12
3	12	12	12	8	8	6	6		12	12	12
4	9	9	9	6	6	4	4		9	9	8

M = Manville, N. J.; W = Waukegan, Ill.; R = Redwood City, Cal. Maximum lengths: Manville, 45" up to 2½" thick and 42" above 2½" thickness; Waukegan, 44"; Redwood City, 36".



*Applying J-M 85% Magnesia blocks to a precipitator casing*



## J-M 85% Magnesia Locomotive Boiler Lagging

The standard boiler insulation for locomotives in the United States is a lagging of 85% Magnesia blocks.

J-M 85% Magnesia lagging is furnished in a standard size, 6" x 36", in the various thicknesses mentioned for J-M 85% Magnesia blocks, but it can be manufactured in smaller pieces when required. It is available in flat or curved, and straight or tapered pieces.

Curved lagging permits a snug fit to the curved portion of the boiler shell and, as the edges are cut radially, allows close fitting of adjacent pieces. This eliminates the open V joints, encountered in the use of flat blocks on curved surfaces, with a resultant increase in overall insulating efficiency.

Tapered lagging is designed to compensate for the thickness of the boiler sheets at the seam laps and thus to provide a uniform contour on the outside surface of the insulation over which to apply the customary iron jacket.

Lagging is regularly furnished in piece lots, as required, or in sets of sufficient material to insulate completely a boiler in accordance with the dimension blue prints or schedules of the railroad or builder.



*Method of applying J-M 85% Magnesia Locomotive Boiler Lagging*

The most commonly used method of fastening the lagging is with special T hooks and wire which are furnished with the lagging when ordered. The wire is passed around the boiler approximately 4" from each end of a lagging course, and as each piece is applied, T hooks are slipped onto the wires to hold the insulation. The hooks secure the lagging firmly in place and permit the removal of individual pieces, when necessary, without disturbing those adjacent.

The maximum temperature to which 85% Magnesia boiler lagging should be subjected is 600 F. Where special conditions or higher temperatures are encountered, Johns-Manville should be consulted for specific recommendations.

### **J-M 85% Magnesia Blocks and Lagging Heat Losses**

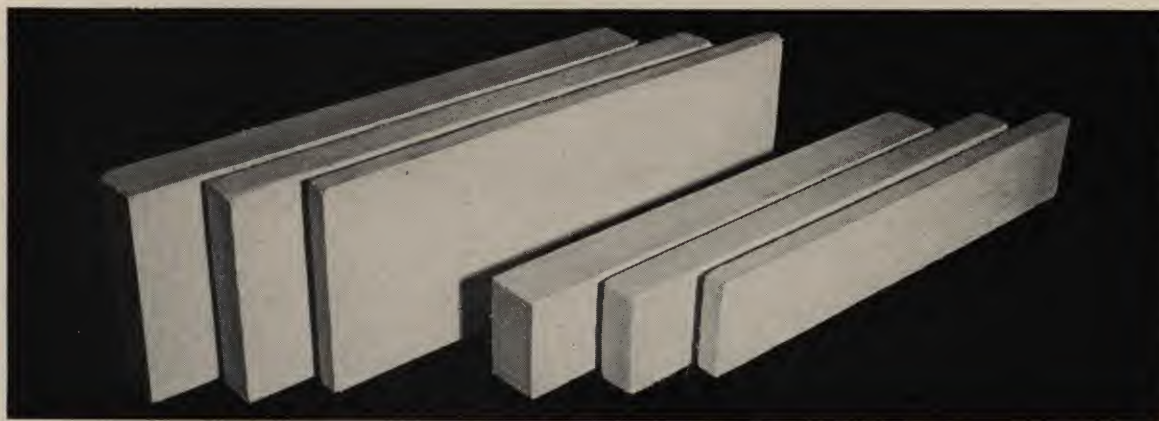
Expressed in Btu per square foot per hour

Insulation thickness, inches	Temperature of surface—F										
	100	150	200	250	300	350	400	450	500	550	600
	Temperature difference between surface and air—F										
	25	75	125	175	225	275	325	375	425	475	525
1 .....	8.44	25.8	43.7	62.4	82.0	103	124	146	169	192	216
1½ .....	6.03	18.4	31.2	44.5	58.2	72.5	87.4	102	118	135	151
2 .....	4.64	14.2	24.0	34.3	45.0	56.1	67.7	79.6	91.8	105	118
2½ .....	3.79	11.5	19.7	28.0	36.6	45.6	54.8	64.4	74.4	85.0	96.2
3 .....	3.27	9.82	16.7	23.8	31.1	38.8	46.6	54.7	63.2	71.8	80.5
3½ .....	2.78	8.52	14.5	20.5	26.8	33.2	40.0	47.0	54.2	62.0	70.1
4 .....	2.41	7.40	12.7	18.1	23.7	29.5	35.4	41.6	48.1	54.6	61.3



# Thermobestos Blocks

For temperatures to 1200 F



Thermobestos\* blocks are used for insulating boilers, tanks, heat exchangers and other equipment having flat or curved surfaces where the temperature on the insulation does not exceed 1200 F.

In the manufacture of Thermobestos, hydrous calcium silicate is combined with asbestos fiber by a special J-M process and formed into blocks of standard sizes and thicknesses.

For the range of temperatures from 600 F to 1200 F where the expansion of equipment is a significant factor, it is recommended that the blocks be applied in double-layer construction with "broken" or staggered joints. This construction prevents appreciable heat losses through open joints caused by the expansion of components, and eliminates damage to the exterior finish at these points. The double-layer construction also minimizes the effects of thermal stresses in the material by reducing the temperature drop across each layer.

## Properties

The figures given in the following table of properties are average values obtained in accordance with accepted test methods.

Density, lb per cu ft	11
Transverse Strength (Modulus of Rupture), psi	60
Compressive Strength (to produce $\frac{1}{8}$ " compression), psi	130
Linear Shrinkage (24-hr soaking period at 1200 F), %	1.5
Conductivity (Btu in. per sq ft per F per hr at mean temperature),	
300 F	400 F
0.45	0.50
500 F	600 F
0.55	0.60

\* Reg. U. S. Pat. Off.

## Sizes and Packaging

Thermobestos Block Insulation is regularly supplied in standard 3-ft lengths, widths of 6" and 12", and thicknesses of 1", 1½", 2", 2½", 3", 3½" and 4". Other widths up to 12" and curved blocks can be furnished on special order.

All sizes of the block insulation are packaged in cartons designed to meet standard commercial handling and shipping requirements.

## Recommended Thicknesses

The following recommended thicknesses are optimum thicknesses calculated on an *economic* basis for heat conservation under average operating conditions and assure adequate temperature control. Unusual conditions may warrant the use of other thicknesses.

Temperature of Surface, F	Thickness, Inches
100 to 199	1½
200 to 299	2
300 to 399	2½
400 to 499	3
500 to 599	3½
600 to 699	3½
700 to 799	4
800 to 899	4½
900 to 999	4½
1000 to 1099	5
1100 to 1200	5½

Thermobestos blocks can be readily cut and applied by means of regular tools and methods utilized by insulation applicators.

Thermobestos is also made in pipe insulation form, as described on another data sheet.







# Superex Blocks

For temperatures to 1900 F

Superex\* block insulation is made from specially selected and calcined diatomaceous silica, blended with other insulating materials and bonded with asbestos fiber. The resulting product combines the essential characteristics of high heat resistance and insulating value. Superex is the most generally adaptable type of insulating material for temperatures ranging between 600 and 1900 F.

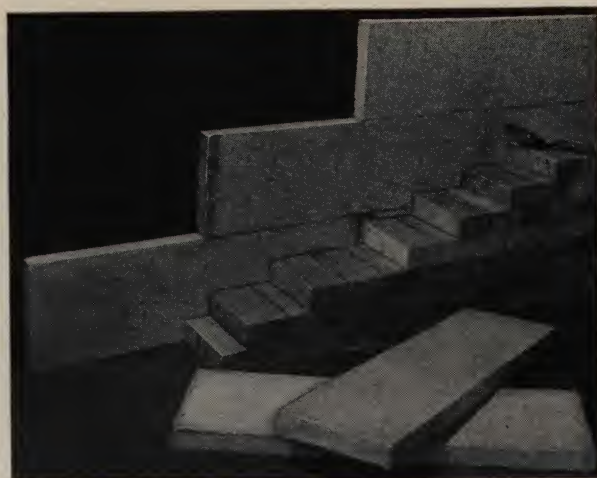
Superex has excellent thermal characteristics and withstands the temperatures in its range with negligible shrinkage. Although weighing only approximately 2 lb per sq ft per inch thickness, this material possesses ample strength for all purposes for which it is recommended.

The insulation is furnished in flat blocks 3", 6", 9" and 12" wide and in standard lengths of 18" and 36". Available thicknesses and maximum lengths obtainable are shown in the table and tabular notes.

Curved blocks are furnished in the sizes and thicknesses indicated in the table. In the 4" thickness, curved blocks are furnished subject to the specific radius required. The radius of curvature which the blocks must fit should be specified on the order.

This material is also furnished in pipe insulation form as described on another data sheet.

Superex blocks are used generally in stationary and marine power plant practice, in industrial and metal-



Superex is the most generally adaptable type of insulating material for temperatures between 600 and 1900 F

lurgical furnaces and ovens, regenerators, kilns, roasters, high temperature mains, flues and stacks. The large-size blocks are especially economical in ease of handling and labor of erection. By applying the insulation in double layer, through joints are eliminated and heat loss reduced accordingly. Often the double layer can economically be made to consist of Superex Combination Insulation, as follows.

## Superex Combination Insulation

Since insulating value generally decreases and cost usually increases with increasing heat resistance of insulating materials, the proper insulation for a given application is one having an insulating value as high as is consistent with sufficient heat resistance for the service temperature, and the physical characteristics necessary for satisfactory performance.

Combinations of insulation generally consist of Superex and 85% Magnesite or Superex and Asbestos-Sponge Felted. These combinations give greater insulating value for a given heat resistance and insulation thickness. The Superex is always used next to the hot surface in sufficient thickness to reduce the temperature on the outer layer to its safe limit. Then the outer layer, with its higher insulating value, serves to reduce the heat loss over that of Superex used alone. The total thickness is usually governed by such economic factors as operating temperature, operating time of equipment, cost of heat, etc. These permit a determina-

\* Reg. U. S. Pat. Off.

### Number of Superex blocks per carton

Thickness, inches	Flat Blocks									Curved Blocks		
	6" x 36"			9" x 36"			12" x 36"			6" x 36"		
	M	W	R	M	W	R	M	W	R	M	W	R
1	30	30	36	—	—	—	—	—	—	—	—	—
1 1/4	24	24	28	—	—	—	—	—	—	24	24	28
1 1/2	20	20	24	16	12	16	10	10	12	20	20	24
1 3/4	16	16	20	14	9	14	8	8	10	16	18	20
2	14	14	18	12	8	12	7	7	9	14	14	18
2 1/4	12	12	16	10	7	10	6	6	8	12	12	16
2 1/2	12	12	14	10	7	8	6	6	7	12	12	14
2 3/4	10	10	12	8	6	8	5	5	6	10	10	12
3	10	10	12	8	6	8	5	5	6	10	10	12
4	7	7	9	6	4	6	4	3	4	7	6	8

M—Manville, N. J.; W=Waukegan, Ill.; R=Redwood City, Calif.  
Maximum lengths: Manville, 42"; Waukegan, 44"; Redwood City, 40".





*Superex Combination used in a steam-generating plant*

tion of the correct inner-layer thickness to resist temperature together with the total *economic* thickness. However, special conditions may, in some cases, preclude an *economic* basis for the determination of thickness.

#### **Recommended Thicknesses of Block Insulation on Metal Surfaces**

Temperature of surface, F	Inner layer: Superex, inches	Outer layer: 85% Magnesia or Asbesto-Sponge Felted, inches	Total thickness of block insulation, inches
100 to 199	—	1½	1½
200 to 299	—	2	2
300 to 399	—	2½	2½
400 to 499	—	3	3
500 to 599	—	3½	3½
*600 to 699	1	2½	3½
700 to 799	1½	2½	4
800 to 899	2½	2	4½
900 to 999	3	1½	4½
1000 to 1099	3½	1½	5
1100 to 1200	4	1½	5½

\* In the temperature range of 600 to 699 F, Asbesto-Sponge Felted may be used alone for the total thickness instead of Superex Combination Insulation.

The preceding table gives J-M recommendations for the use of Block and Superex Combination Block Insulation on metal surfaces for temperatures to 1200 F. In order to use the table it is necessary only to select the insulation or combination which corresponds to the maximum temperature of the surface to which the insulation will be applied.

The recommended thicknesses are optimum thicknesses calculated on an *economic* basis for heat conservation under average operating conditions and

assure adequate temperature control. Unusual conditions may warrant the use of other thicknesses. Where a different thickness of insulation is used than indicated in the table, the relative thicknesses of Superex and 85% Magnesia or Asbesto-Sponge Felted should not be less than the proportions shown.

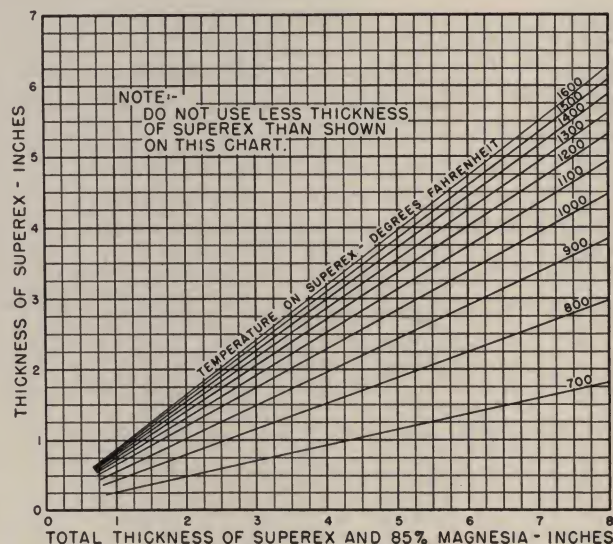
A typical finish over the insulation is hard finish asbestos cement, ½" thick. If the cement finish is used outdoors, the last ¼" of cement is replaced with Insulkote ET.

Superex Combination Insulation is also furnished for application to pipes, as shown on another data sheet.

#### **Furnace Insulation:**

The same principles of combination insulation apply to the insulating of furnaces as to metal surfaces, except that brickwork has appreciable resistance in itself to the flow of heat. This changes the *economic* thickness of insulation and also introduces another factor which affects the thickness of Superex to be used. When Superex is applied to a fire brick wall, the temperature on the Superex will be increased materially above the temperature of the uninsulated brick exterior. Thus it is sometimes necessary to restrict the thickness of Superex to avoid exceeding its maximum service temperature limit on high temperature furnaces.

Where the use of brick shapes is advantageous, JM-1620 Insulating Fire Brick or Sil-O-Cel 16L Brick



The chart above shows the minimum thickness of Superex necessary in Superex-85% Magnesia Combination to reduce the temperature on the 85% Magnesia to below 600 F when applied on flat surfaces. (For temperatures on the Superex between 1600 and 1900 F, the use of Superex alone is recommended)



are used instead of Superex Blocks in the range up to 1600 F. JM-20, 23, 26, 28 and 3000 Insulating Fire Brick or Fireblok, or Sil-O-Cel C-22 and Sil-O-Cel Super Brick are used to take care of insulating requirements where temperatures to 3000 F will be applied to the insulation. The Sil-O-Cel Brick are used behind refractory protection and the J-M Insulating Fire Brick or Fireblok both as an insulating refractory or behind refractory protection.

Furnace insulation is a highly profitable investment from the standpoint of heat saving alone. Added to this is the lessening of internal strains and reduction in spalling because of the smaller temperature differential between the inside and outside of the refractory. Wall cracks, caused by uneven expansion and contraction, are fewer and smaller. Properly applied, the insulation tends to seal cracks in furnace walls and prevents the infiltration of air or exfiltration of furnace gases.

When insulation is placed over the exterior of furnace brickwork, considerably more resistance is introduced in the path of heat flowing directly to the outside. This promotes heat flow along the walls, and cooler portions of the furnace are raised to a higher temperature. Sharp temperature changes are obviated and adjacent brickwork is protected against widely varying rates of expansion. Lower temperatures may be used in the heating zone and adequate temperatures still be



*Erecting the lining in a hot blast stove using Superex blocks between the steel shell and the fire-brick lining*



*Soaking pit under construction showing installation of Superex blocks between the steel casing and the pit lining*

maintained throughout all portions of the furnace setting. This saves fuel and further prevents rapid deterioration of the refractories.

The modern furnace wall is cased with Transite sheets or with steel plate. Care is taken to leave the main supporting steel sufficiently exposed to the air so that its strength will not be affected by the heat.

It has been found entirely satisfactory to apply Superex and 85% Magnesia blocks and Sil-O-Cel Brick or J-M Insulating Fire Brick between the refractory and buckstays except at places of unusual thrust, such as opposite a sprung arch, or where castings and steel work are hung into the brickwork. In such locations the fire brick is carried through the insulation to the outside of the furnace.

before the casing is applied, a space equivalent to the

When it is expedient to erect the furnace brickwork thickness of the insulation is left between the outside face of the brick and the inside face of the buckstays. Then insulating blocks or bricks are erected to fill this space and the Transite casing secured flush with the back of the buckstays by steel battens and toggle bolts or other suitable means.

Where the furnace brickwork is erected flush with the back of the buckstays, light angles may be clipped or spot-welded to the buckstays to allow the application of insulation between vertical steel members. These angles serve to support the  $\frac{3}{8}$ " Transite casing.







# Fire-Felt Sheets and Blocks

## Super Fire-Felt

*For temperatures to 700 or 900 F*

Super Fire-Felt is constructed of asbestos fiber which is felted and formed into sheets, blocks and special shapes. The long fiber used is processed and felted to produce an insulation light in weight and low in thermal conductivity.

Super Fire-Felt is frequently used in boiler tube doors where considerable mechanical strength is required to withstand the vibration due to the opening and closing of doors. For air passages over ventilated boiler walls this material finds excellent application. It is designed and recommended for use where insulation in relatively large sheets is desirable and where a resilient insulation is necessary because the material will be subjected to compression or strain, due to expansion or contraction. However, it should not be used where unusually high resistance to compression is required.

Super Fire-Felt, used between metal sheets or between a brick lining and steel shell, will give satisfactory service at temperatures up to 900 F. Where less effectively supported, however, or where subjected to removal and replacement, the material has a temperature limit of 700 F under normal service and 500 F if conditions of excessive vibration are encountered.

Super Fire-Felt is furnished standard in sheets 24" x 36" and blocks 6" x 36", from 1/2" to 4" in thickness in increments of 1/4" up to 2" thick and increments of 1/2" from 2" to 4" thick; also in spe-



*Super Fire-Felt Sheets*

cial sizes and shapes. The weight of the material is approximately 1.7 lb per sq ft per inch of thickness.

The process of manufacturing will not permit furnishing sheets to exact dimensions. It is necessary to provide for the following tolerances:

Length and width of sheets  $\pm 1/4$ "

Length of blocks,  $\pm 1/4$ "

Width of 6" blocks,  $\pm 1/8$ "

Thickness,  $\pm 1/8$ " per 1" of thickness.

A decided advantage in the use of large sized sheets in which the various forms of Fire-Felt are furnished is that this permits application with few joints, compared with the large number required with a small block material. This decreases heat loss through joints and permits greater speed when large areas are to be insulated.

As Super Fire-Felt is readily moulded, it is recommended for the insulation of apparatus requiring special or irregular shapes. These moulded shapes

## Super Fire-Felt Heat Losses and Efficiencies

Heat losses expressed in Btu per square foot, per degree temperature difference, per hour.  
Efficiency expressed in percentage of bare surface losses.

Insulation thickness inches		175	Temperature of surface—F							
		275	375	475	575	675	775	875	975	
		Temperature difference between surface and air—F								
		100	200	300	400	500	600	700	800	900
1	Heat Loss, Btu.....	.368	.391	.416	.442	.469	.497	.525	.554	.584
	Efficiency %.....	82.90	85.32	87.26	89.08	90.49	91.50	92.28	92.85	93.28
2	Heat Loss, Btu.....	.204	.217	.230	.245	.260	.275	.290	.306	.322
	Efficiency %.....	90.52	91.85	92.95	93.33	94.72	95.30	95.74	96.05	96.30
3	Heat Loss, Btu.....	.141	.150	.159	.169	.180	.191	.202	.213	.224
	Efficiency %.....	93.45	94.37	95.12	95.81	96.34	96.74	97.03	97.25	97.42
4	Heat Loss, Btu.....	.108	.115	.123	.130	.138	.146	.155	.164	.173
	Efficiency %.....	94.98	95.68	96.26	96.78	97.19	97.50	97.72	97.88	98.00



are particularly effective and satisfactory because of the ease of application and the elimination of the many joints necessary where insulation in the form of small blocks is used.

Where special or irregular shapes are required, complete dimensions and details, with blueprints, should accompany the order or request for quotation.

### Asbestos Fire-Felt

*For temperatures to 1000 F*

Asbestos Fire-Felt sheets and blocks, suitable for temperatures up to 1000 F, are made by felting and moulding asbestos fibre into sheet or block form, producing a heat-resisting material which is strong and resilient, and which will not readily powder or crumble even when applied to surfaces that move or

vibrate. It is generally used in place of Super Fire-Felt where greater mechanical strength is required.

Furnished in standard flat or curved sheets 24" x 36", and blocks 6" x 36". Thicknesses and approximate weights are given below:

Thickness, inches	Weight, lb per sq ft	Thickness, inches	Weight, lb per sq ft
$\frac{1}{2}$	1.8	2	5.9
$\frac{3}{4}$	2.6	$2\frac{1}{2}$	7.1
1	3.3	3	8.1
$1\frac{1}{4}$	4.0	$3\frac{1}{2}$	9.0
$1\frac{1}{2}$	4.7	4	9.7
$1\frac{3}{4}$	5.3	—	—

Tolerances for Super Fire-Felt also apply to Asbestos Fire-Felt

Like Super Fire-Felt, Asbestos Fire-Felt offers the advantage of large size sheets and is readily moulded to irregular shapes. Where special shapes are required, dimensions and details, with blueprints, should accompany order or request for quotation.

## Asbestos Fire-Felt Pipe Insulation

*For temperatures to 1000 F*



*Asbestos Fire-Felt pipe insulation withstands the severe conditions common to railroad and industrial plant service*

Asbestos Fire-Felt pipe insulation, suitable for temperatures up to 1000 F, is composed of asbestos fiber felted and moulded into sections. The material is similar to Asbestos Fire-Felt sheets and blocks.

The process of manufacture produces a strong, resilient material unaffected by vibration, expansion and contraction and many other severe conditions.

Asbestos Fire-Felt is particularly adapted for use on hot oil lines, gas engine exhaust lines, etc., where temperatures are high and where conditions of vibration or mechanical abuse would cause other moulded insulations to deteriorate rapidly.

The material is furnished in 3-ft. sections 1" to 3" thick in increments of  $\frac{1}{2}$ ", with canvas jacket and brass-lacquered bands, to fit standard piping.

*Weight in pounds per standard 3-foot section, uncrated\**

Thickness inches	Nominal pipe sizes, inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
1	4.8	5.06	5.35	6.0	6.4	7.08	7.88	8.8	9.53	10.3	11.1	12.0	13.6	15.2	16.8	18.2	19.9	23.0
1½	9.7	10.10	10.60	11.4	12.0	12.90	14.00	15.4	16.40	17.5	18.5	19.8	22.0	24.2	26.3	28.4	30.7	35.0
2	13.0	13.60	14.30	15.6	16.4	17.80	19.30	21.3	22.80	24.4	26.0	27.8	31.1	34.3	37.5	40.7	44.2	50.6
3	23.0	23.80	24.90	27.0	28.2	30.40	32.80	35.9	38.40	40.8	43.4	46.1	51.3	56.2	61.0	66.1	71.4	81.4

\* For estimating crated weight, add 25 percent.



## Asbestocel Sheets and Blocks

*For temperatures to 300 F*

Asbestos\* sheets and blocks are used for insulating medium or low pressure boilers, dry rooms, warm air ducts and other surfaces where temperatures are not extreme. The temperature limit is 300 F.

The sheets and blocks are made of alternate plain and corrugated asbestos felts, built up in layers to the proper thickness.

Asbestocel is furnished standard in 4 plies per inch of thickness in sizes 6", 9", 12", 18" and 36" wide by 36", 48", 72" and 96" long, from 1/2" to 4" in thickness. Weight of 4-ply material approximately 1 lb per sq ft per inch of thickness.

This material can also be furnished in 6 plies per inch of thickness, known as Fine Corrugated Asbestocel, in the same sizes as the coarse-corrugated material. Weight of Fine Corrugated is approximately 1.3 lb per sq ft per inch of thickness.

\* Reg. U. S. Pat. Off.



### Heat Losses

Expressed in Btu per square foot per degree temperature difference, per hour.

Insulation thickness, inches		Temperature of surface—F			
		125	175	225	275
		Temperature difference between surface and air—F			
		50	100	150	200
1	Heat Loss, Btu.....	.411	.424	.444	.464
1½	Heat Loss, Btu.....	.295	.306	.320	.335
2	Heat Loss, Btu.....	.231	.239	.250	.262
2½	Heat Loss, Btu.....	.190	.197	.206	.216
3	Heat Loss, Btu.....	.161	.167	.175	.183
3½	Heat Loss, Btu.....	.140	.145	.152	.159
4	Heat Loss, Btu.....	.123	.128	.134	.141

## Cellamite Sheets and Blocks

*For temperatures to 700 F*

Cellamite\* sheets and blocks are used for insulating ovens and dryers and air-conditioning equipment where humid conditions are encountered. Manufactured in the same manner as Asbestocel sheets and blocks, Cellamite may be used instead of Asbestocel

where greater strength is required. Cellamite is entirely inorganic, and is used for temperatures to 700 F.

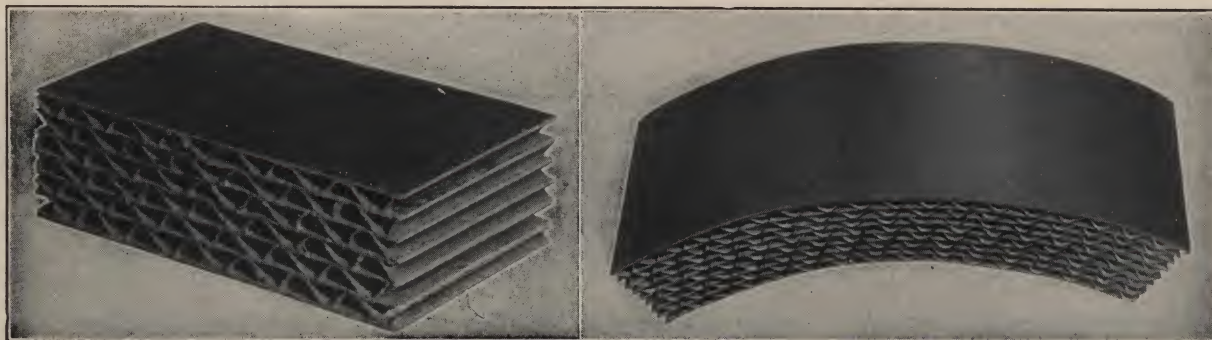
The material is furnished 36" wide, 36" and 72" long, and in the thicknesses of 1/2", 1", 1 1/2", 2", 2 1/2" and 3". Average compressive strength is 85 psi, and average density is 16 lb per cu ft.

\* Reg. U. S. Pat. Off.



# Vitribestos Sheets

For temperatures to 700 F



Vitribestos is recommended for lining smokestacks and flues, and for use where a strong, stiff insulating sheet is required for temperatures to 700 F. Where extreme moisture conditions exist, such as stacks unheated for long periods or where natural gas is the fuel burned, special recommendations will be furnished.

Vitribestos is made of asbestos felts, corrugated and built up to form a cellular sheet. The sheets are processed and vitrified, which increases their resistance to moisture and high temperatures.

The sheets are made either flat or curved to any radius. They provide a more satisfactory and practical steel stack or flue lining than fire brick because they are much lighter in weight and have a greater insulating value per inch of thickness. A vitribestos lining, 2" thick and weighing less than 5 lb per sq ft, is a more efficient insulator than fire brick lining, 5" thick and weighing approximately 50 lb per sq ft. The brick lining obviously reduces the cross section of the stack much more than the thinner Vitribestos lining.

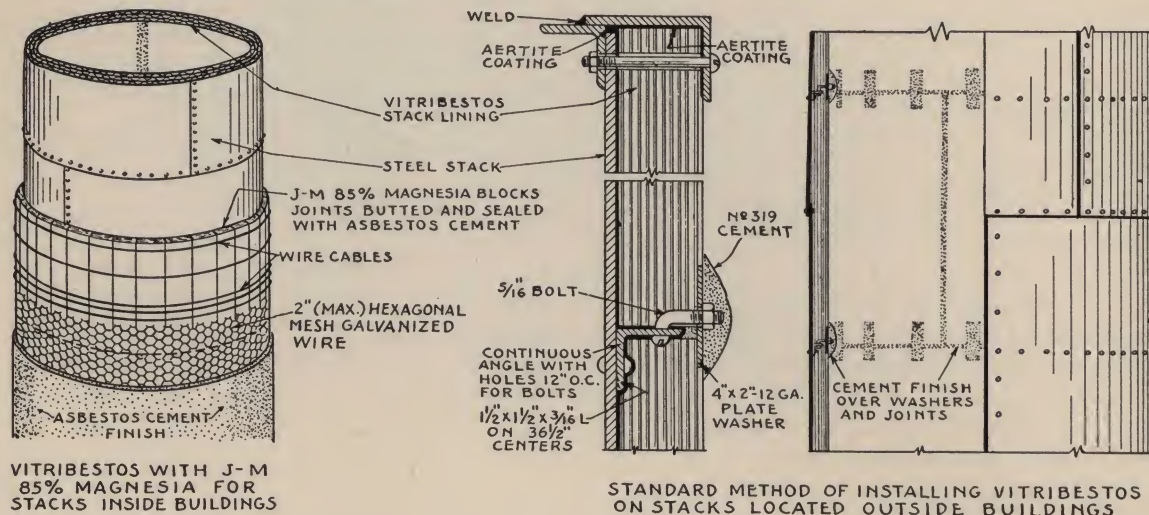
Vitribestos is regularly furnished in standard size flat sheets, 36" x 36" and 36" x 72", and curved sheets, 24" x 36", in thicknesses from 1/2" to 3" in increments of 1/4". Other sizes furnished on order. Curved sheets are curved along the 24" dimension.

The weight is approximately 1.8 lb per sq ft per inch of thickness.

Vitribestos, when used as a stack lining, is held in place and supported by steel angles, the application of which depends upon the construction of the stack. Stack application drawings appear below. Complete construction details appear on a separate data sheet.

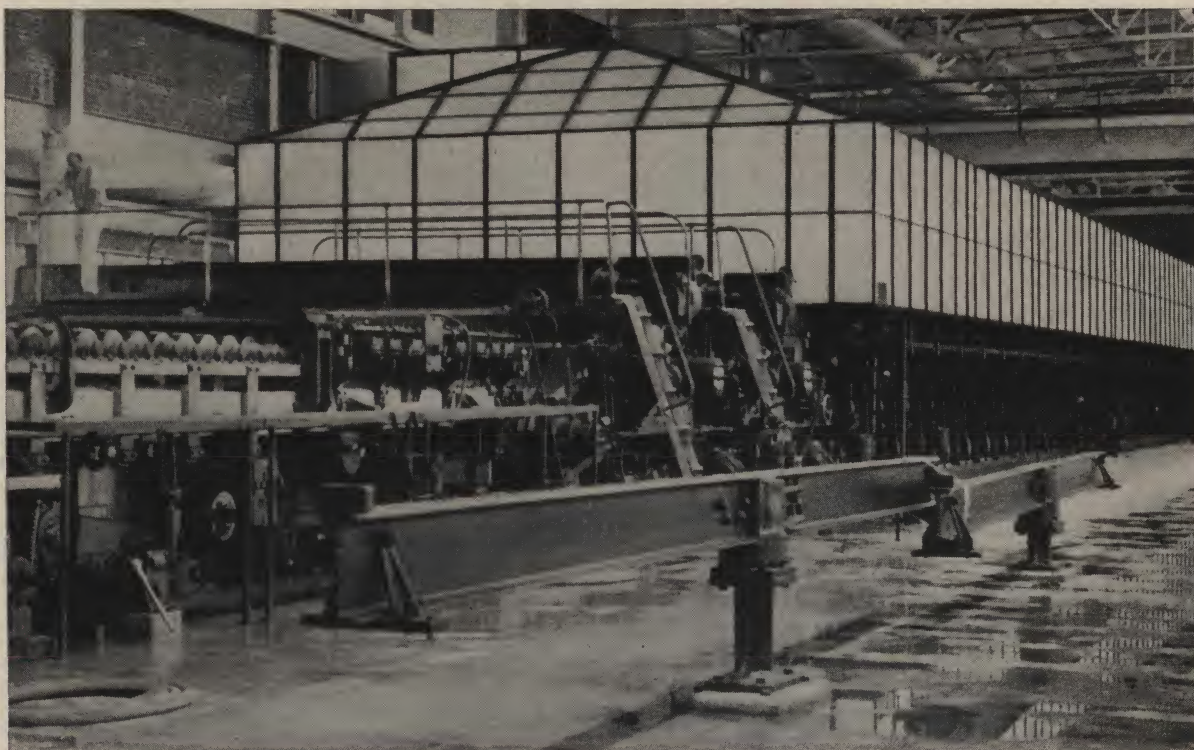
Vitribestos can also be furnished in pipe covering form, on special order.

To prevent possible corrosion, the stacks or flues should be protected on the inside surface with Aertite Coating before the Vitribestos Sheets are applied. Because of its volatile nature, any welding on the stack or flue surface should be performed before application of the Aertite Coating.





## Flat Transite Sheets



*This large paper-machine hood, for controlling condensation, is built with long-lasting, inorganic Flat Transite sheets*

Flat Transite\*, a Johns-Manville asbestos-cement sheet product, is widely used by industry for building protective casings over insulation on boilers, furnaces, tanks and similar equipment. It is also used in industrial plants for various types of housings over machinery and other equipment, on cooling towers, for paper machine hoods, ducts, baffles, drying ovens and countless other applications requiring a strong, durable sheet material. Flat Transite is suitable for continuous service at temperatures up to 600 F.

Light gray in color, inorganic Flat Transite sheets are manufactured from a homogeneous mixture of asbestos fibers and portland cement. These materials are formed under high pressure into dense, incombustible, monolithic sheets which are exceptionally resistant to corrosion and weather. Flat Transite does not require painting or other preservative treatment.

### How Furnished

Flat Transite sheets are furnished as shown in the

\* Reg. U. S. Pat. Off.

table following. When requested, sheets can be supplied with one side and one end trued so as to form an accurate 90-degree included angle. Sheets can also be furnished (on special order and at extra cost) in cut pieces; with straight, circular or square cut-outs; with bevels; and with drilled, countersunk, counterbored or bind holes.

During manufacture, Flat Transite sheets may be curved in any one direction. The minimum radius of curvature depends upon the thickness of the sheet. Curved sheets can be furnished on special order and at extra cost.

### Application and Handling

The convenient sizes of Flat Transite sheets and their excellent workability makes them easy to handle and apply. Transite can be cut easily with a hand saw (set 5 to 7 points per inch) and with power driven saws, portable or stationary, using carbide-tipped steel wheels or steel-centered abrasive wheels. Holes can be quickly



drilled in Flat Transite sheets with ordinary twist drills. Corners and edges can be rounded or beveled with a coarse file. Sheets can be fastened to framework with standard screws, bolts or special mechanical fasteners. To allow for movement, holes should generally be drilled oversize.

**Recommended Maximum Spans for Flat Transite**

Sheet Thickness, inches	Horizontal Span (underside), inches	Vertical Span, inches
$\frac{1}{4}$	24	36
$\frac{5}{16}$	32	39
$\frac{3}{8}$	36	42
$\frac{1}{2}$	42	48
$\frac{5}{8}$	45	54
$\frac{3}{4}$	49	60
1	54	72

Sheet sizes, thickness, weights, finishes and manufacturing tolerances will be found in the following table of data on Flat Transite sheets.



*A section of a fabricated Flat Transite duct*

**Data on Flat Transite Sheets**

*Nominal Sheet Size, inches	Thickness Range, inches	Thick- ness, inches	Approx. Wt., lb per sq ft		Finishes		Thickness Tolerances		
			Uncrated	Crated	Type of finish	Description of surface	Type of finish	Thickness, inches	Tolerance, inches
36 x 48	$\frac{1}{4}$ thru 2	$\frac{1}{4}$	2.7	3.1	Standard (furnished un- less otherwise specified)	Smooth, un- sanded one side; finely screen-marked opposite side	Standard	$\frac{1}{4}$ thru $\frac{5}{8}$ $\frac{3}{4}$ and over	$\pm \frac{3}{64}$ $\pm \frac{1}{16}$
42 x 48	$\frac{1}{4}$ thru 4**	$\frac{5}{16}$	3.3	3.9			Sanded or Polished One Side	All thicknesses	$\pm \frac{1}{16}$ ( $\pm \frac{1}{32}$ on pieces 12" x 96" or less in both dimensions)
42 x 96	$\frac{1}{4}$ thru 2	$\frac{3}{8}$	4.0	4.6	Sanded One Side	Smooth, un- sanded one side; drum- sanded to remove screen marks from opposite side		$\frac{1}{4}$ thru $\frac{5}{8}$	$\pm \frac{1}{32}$ ( $\pm \frac{1}{64}$ on pieces 12" x 96" or less and 24" x 24" or less in both dimen- sions)
48 x 48	$\frac{1}{4}$ thru 2	$\frac{1}{2}$	5.2	6.0			Sanded or Polished Two Sides		
48 x 96	$\frac{1}{4}$ thru 2	$\frac{5}{8}$	6.5	7.5					
		$\frac{3}{4}$	7.8	9.1	Sanded Two Sides	Both sides drum-sanded smooth			$\pm \frac{3}{64}$ ( $\pm \frac{1}{64}$ on pieces 12" x 96" or less and 24" x 24" or less in both dimen- sions)
		$\frac{7}{8}$	9.0	10.4	Polished One Side	Smooth, un- sanded one side; opposite side drum and belt-sanded very smooth		$\frac{3}{4}$ and over	
		1	10.3	12.3					
		$1\frac{1}{4}$	12.2	14.2	Polished Two Sides	Both sides drum and belt- sanded very smooth			
		$1\frac{1}{2}$	14.6	18.0					
		$1\frac{3}{4}$	17.0	20.5					
		2	19.4	23.0					

\* Unless order specifies sheets are to be trimmed to nominal size, they will be furnished untrimmed. Trimmed sheets have a tolerance of  $\pm \frac{1}{8}$ " in length and width. Untrimmed sheets are up to  $1\frac{1}{2}$ " oversize in length and  $\frac{3}{4}$ " oversize in width.

\*\* This size in thicknesses of  $2\frac{1}{2}$ ", 3",  $3\frac{1}{2}$ " and 4" available on special order only.



## Asbestocite



*Whether outdoor tanks or vessels operate at temperatures which are high, low or close to that of the surrounding air, Johns-Manville Weather-Protected Insulation will assure greater fuel savings and more efficient operation of equipment*

Asbestocite\* is a Johns-Manville asbestos-cement sheet product which has proved to be a most effective material for the protection of insulated outdoor stacks, tanks, vessels and equipment against climatic and other deteriorating conditions. After the insulation has been applied by standard methods, the Asbestocite sheets are fastened in a simple manner over the insulating materials to form the protective casing or "finish." The sheets can also be used for the protection of insulated indoor tanks, vessels and equipment subject to spill-over, many chemical atmospheres, and similar conditions.

In manufacture, a homogeneous mixture of asbestos fibers and cement is formed under high pressure into strong, flexible sheets with a smooth, hard finish and natural gray color. Two types are available: Asbestocite "A", and Asbestocite "B". Asbestocite "B" is stronger, has lower thermal and moisture expansion characteristics, and is more moisture and weather-resistant.

\* Reg. U. S. Pat. Off.

### Advantages of Asbestocite

Although a dense, monolithic sheet material, Asbestocite is readily workable and easily applied. The following paragraphs summarize the outstanding advantages of the product:

**Weather-Resistant:** Highly resistant to the effects of the weather and many chemical liquids and atmospheres. In addition, the sheets are not affected by freezing and thawing.

**Exceptionally Durable:** Safeguards the normal long-life expectancy of the insulation, thus providing savings of fuel and maintenance for many years.

**Maintenance-Free:** These incombustible, inorganic sheets are virtually maintenance free, in that they do not require painting or other preservative treatments.

**Easily Applied:** Quickly and easily applied over the insulation, following simplified specifications.





After the insulation has been applied by standard methods, the Asbestocite sheets are fastened in a simple manner over the insulating materials

### Sizes, Weights and Packaging

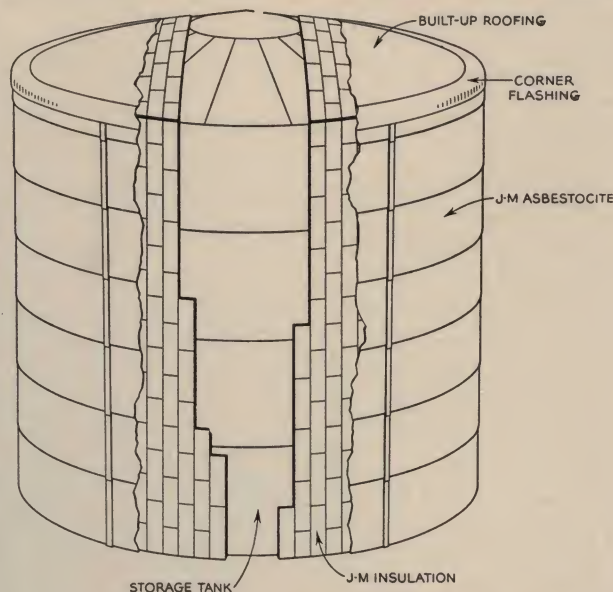
Asbestocite sheets are furnished in sizes 4 ft x 4 ft and 4 ft x 8 ft. The  $\frac{1}{8}$ " and  $\frac{3}{16}$ "-thick sheets are taped in packages. The  $\frac{1}{4}$ "-thick sheets are supplied unpackaged. All sheets can be supplied crated at additional cost. Detailed packaging data and approximate weights are given in the table.

Size, feet	Thickness, inches	Sheets per package	Sq ft per package	Wt per package, lb	Wt per 1000 sq ft, lb	Wt per sheet, lb
<b>Asbestocite "A"</b>						
4 x 4	$\frac{1}{8}$	2	32	40	1235	20
4 x 8	$\frac{1}{8}$	2	64	79	1235	40
4 x 4	$\frac{3}{16}$	2	32	56	1750	28
4 x 8	$\frac{3}{16}$	2	64	112	1750	56
4 x 4	$\frac{1}{4}$	Unpackaged	—	—	2470	40
4 x 8	$\frac{1}{4}$	Unpackaged	—	—	2470	80
<b>Asbestocite "B"</b>						
4 x 4	$\frac{1}{8}$	2	32	36	1100	18
4 x 8	$\frac{1}{8}$	2	64	71	1100	36
4 x 4	$\frac{3}{16}$	2	32	48	1500	24
4 x 8	$\frac{3}{16}$	2	64	96	1500	48

### Application and Handling

Asbestocite can be readily applied over insulations following simplified Johns-Manville specifications and instructions which are available in other descriptive literature.

The sheets are comparatively light in weight and have sufficient strength to be handled by one workman. They can be easily cut on the job or in a shop with ordinary hand saws or with power-driven portable or stationary



Cut-away drawing of Johns-Manville Weather-Protected Insulation applied to an outdoor tank

saws. The use of carbide-tipped steel wheels or steel-centered abrasive wheels in power saws has proved most successful. Sheets can also be "scored" along a straight-edge with a sharp, hard-pointed awl or carbide-tipped blade and the projecting piece then "snapped-off" intact.

For large jobs, the J-M Shearing Jig can be employed to accurately shear Asbestocite sheets in about one-sixth of the time required for hand sawing. This jig is compact, lightweight and portable. It can be easily operated by one workman and does not require power.

Full size, 4 ft x 8 ft, Asbestocite sheets can be applied over curved surfaces within the following limitations:

Thickness of Sheet		Minimum Radius of Curvature	
Asbestocite Type "A"	Asbestocite Type "B"	Lengthwise (Longitudinal)	Crosswise (Transverse)
$\frac{1}{8}$ "	$\frac{1}{8}$ "	30"	36"
$\frac{3}{16}$ "	$\frac{3}{16}$ "	36"	54"
$\frac{1}{4}$ "	—	66"	72"



Insulated Breeching with Asbestocite Casing



## Marinite-36 for Industrial Use

*Type A (Plain Finish)—for continuous service at temperatures to 900 F*

*Type B (Oil Finish)—for continuous service at temperatures to 250 F (Owing to smoking of the oil)*



*Marinite-36, readily adaptable for continuous oven andlehr construction, decreases heat losses owing to the absence of "through metal"*

Marinite\*-36 was developed to meet the demand for a light-weight, fireproof sheet material to be used in ship construction for joiner work and as an insulation. The adoption of Marinite-36 as a general insulating and fireproofing material in the industrial field has met with the same outstanding success as in marine service.

Its acceptance as a structural and insulating material for use in ovens and driers, heat shields, ducts and breechings, etc., and as a fireproofing medium for structural steel, particularly in oil refineries, can be attributed to the following desirable characteristics: Fireproof, light weight, low thermal conductivity, flexibility of use, and ability to be cut and worked as wood.

### Description

Marinite-36 is a solid, homogeneous sheet material made of asbestos fiber with an inorganic binder. Two types are available: Type A sheets with a plain sanded finish on both sides for use where painting is not required; and Type B sheets, sanded on both sides, with a baked-on linseed oil finish where subsequent painting is necessary or desirable. Details involving the cutting,

working and painting of Marinite-36 are covered on separate data sheets.

Sheets are supplied in standard sizes of 36" x 96", 42" x 96", 48" x 96", and 48" x 120", in thicknesses of 1/2", 3/4", 7/8" and 1". Cut sheets from these standard sizes are available at extra cost. The tolerances for standard sizes and cut sheets are: length or width,  $\pm 1/8"$ ; thickness,  $\pm 1/32"$ . Panels, consisting of two or more sheets bolted together for oven housings and driers, are available  $\pm 1/16"$  in any dimension. Sheets can also be obtained untrimmed to give up to 1" over-size in width and up to 1 1/2" in length at no extra charge when it is desired to cut Marinite-36 on the job for individual uses. Weights of Marinite-36 are shown in the following table.

Type A (Plain Finish)		Type B (Oil Finish)	
Thickness, inches	lb* per sq ft	Thickness, inches	lb* per sq ft
1/2	1.55	1/2	1.80
3/4	2.32	3/4	2.57
7/8	2.71	7/8	2.95
1	3.10	1	3.34

\* Weights may vary  $\pm 10$  percent; for shipping weights, add approximately 12 percent.

\* Reg. U. S. Pat. Off.



The temperature limit for continuous service is 900 F for Type A (untreated) and 250 F for Type B (oil-treated). In certain cases where Type B will be protected with special heat-resisting paints, it can be used at slightly higher temperatures.

### Uses of Marinite-36

The uses of Marinite-36 in industry are so numerous and varied only a few specific adaptations are listed.

**Ovens and Driers:** Because of its low thermal conductivity and high structural strength, Marinite-36 is an excellent material for oven and drier housings, replacing such constructions as steel facings with common types of insulation between.

Included among the several important advantages of Marinite-36 over the usual type of housings are: Minimum amount of "through-metal" heat loss; even temperatures without "hot spots"; non-metallic material not subject to ordinary forms of corrosion; easy to construct and install; panels easily removable and replaceable.

Marinite-36 housings are equally suitable for walk-in driers and core ovens, or the tunnel type of oven or lehr. Its use assures maximum economy and efficiency for bread and biscuit ovens, paint and welding-wire driers, enameling, japanning or lacquering ovens, textile driers, etc. Full details covering Marinite-36 for industrial ovens and driers are given on separate data sheets.

**Fire Protection of Structural Steel:** Owing to the detrimental effect of high temperature on the strength of steel, all load-bearing members, such as beams, girders and columns should be enclosed with an efficient fireproofing material. One of the most practical methods of providing this vital protection consists of enclosing or boxing the structural members with Marinite-36. Its light weight makes the material easy to handle and imposes a minimum amount of additional load on the steel and foundations. In addition to providing adequate protection and easy erection, the sheets can be removed and replaced quickly. This is an important advantage since the steel is readily accessible for inspection or painting. Complete details are given on separate data sheets.

**Insulation of Indoor Breechings:** The use of Marinite-36 has proved to be a practical and economical material for the insulation of indoor breechings. One of the important functions of breeching insulation is to prevent condensation of the moisture in flue gases



*Marinite-36 is a particularly effective material for the insulation and protection of indoor breechings*

and resultant corrosion of the breeching steel. To accomplish this, the insulation must be applied to the outside of the breeching. When block insulation with cement finish is used, expansion of the breeching with temperature often causes cracking of the finish, necessitating frequent maintenance. This problem is eliminated with Marinite-36, a structural material which can be easily secured to the outside of the breeching by a method which permits ready movement of the sheets with expansion of the steel.

The Marinite-36 presents an attractive panel finish, requiring no supplemental protection.

**Boiler and Engine Rooms:** Marinite-36 in 1" thickness offers a very practical material for insulating the ceilings and walls of boiler and engine rooms, steam distribution rooms, pipe corridors, etc., for apartments, hotels, and industrial buildings. It serves as a decorative as well as an insulating medium.

### Other Uses

The unusual combination of structural characteristics and low thermal conductivity makes Marinite-36 suitable for a large variety of industrial uses such as heat shields to confine high temperature air and increase the efficiency of sulphur burners in paper mills, shields around hot equipment such as involved in welding operations, insulation of crane cabs and fire pits in steel mills, etc.

Other miscellaneous uses include fireproofing filing cabinets, housings for motor-operated valves, duct construction, lining dust collecting equipment, and a base for decorative veneers.



## J-M Marine Joiner Materials and Structural Insulations



*Marinite was used for the bulkheads and ceiling of this modern stateroom*

Ships' accommodation spaces demand walls and ceilings that are both attractive and durable. Governmental regulations require that the materials used must provide an incombustible barrier to the passage of fire. For decorative designs, a diversity of fine finishes is essential. For comfort, a reasonable freedom from nearby noise, a warmth of feeling and touch compatibility should be expected.

Structurally, the joiner materials comprising the walls and ceilings must possess the following qualities: ample strength with minimum weight; immunity to mold or vermin under, at times, highly moist atmospheres; and satisfactory resistance to heat and sound. Collateral essentials are ease of handling, working and installing, satisfactory screw-holding power, and an absence of drumming.

The accompanying deck and shell insulation must fulfill the essential requirements of low thermal conductivity combined with light weight, incombustibility, high resistance to moisture and immunity to mold. The insulations must also permit rapid and economical installation.

\* Reg. U. S. Pat. Off.

The installation of over 30 million square feet of Johns-Manville Marine Joiner Materials aboard ships fully demonstrates their suitability. Under the severe conditions of war-transport service, Marinite-36 and Marinite-65 panels successfully met the abuse from the hundreds of thousands of troop-passengers. Today, they are the standard joiner materials for the building or reconversion of ships in this country.

The group of J-M products which fall under the general classification of marine joiner materials and structural insulations are: Marinite\*-36, Marinite-23, Marinite-65, Transitone\* Marinite, Marine Veneer, Marine Acoustical Unit, BX-Spintex\*, Reeferite\*, and BX-Marine Block. All of the products mentioned are approved for passenger and passenger-cargo vessels by the U. S. Coast Guard and meet the requirements of the U. S. Maritime Administration and the U. S. Public Health Service.

A summary of these materials is given in the following table. The J-M designations shown in the last column are used in ordering. Each designation is fully explained in a separate table which follows after the main summary table.



**Summary of J-M Marine Joiner Materials and Structural Insulations**

Description of Material and Recommended Use	Standard Sizes	Standard Overall Thicknesses	Finishes (also see separate table)
<b>MARINITE-36:</b> A lightweight, incombustible, solid panel of high thermal insulating and acoustical value. Made of asbestos fiber, diatomaceous silica and an inorganic binder. Designed primarily for use in $\frac{7}{8}$ " thickness as a divisional bulkhead. It is also used for shell lining and occasionally as a ceiling for fireproofing the deck overhead without supplementary insulation.	36" x 96", 42" x 96" 48" x 96", 48" x 120" Tolerances: $\pm \frac{1}{16}$ " in length and width	$\frac{1}{2}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1" Tolerances: Unfaced = $\pm \frac{1}{32}$ " Veneered = $\pm \frac{1}{16}$ "	PP, OO, SB1, SB2, MO, MM, Wood, Metal, Plastic
<b>MARINITE-65:</b> Similar in appearance to Marinite-36 but heavier and stronger. Used primarily for erection to furring in $\frac{1}{2}$ " thickness for linings, and in $\frac{3}{8}$ " thickness for ceilings.	(Same as for Marinite-36 above)	$\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1" Tolerance (Unfaced): $\pm \frac{1}{32}$ "	PP, OO, SB1
<b>MARINITE-23:</b> Extra lightweight core panel, similar in appearance to Marinite-36 but lighter and less strong. Furnished only on special order as a core panel for supplemental veneered facings.	(Same as for Marinite-36 above except no MO or MM on 48" x 120")	$\frac{7}{8}$ ", 1" Tolerance (Veneered): $\pm \frac{1}{16}$ "	PP or OO for veneering by others. MO, MM, Wood, Metal, Plastic
<b>TRANSITONE MARINITE:</b> An integrally colored material, much heavier and stronger than Marinite-36. Provides a bulkhead and lining panel requiring no paint or other finish. On special order only.	48" x 96"	$\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{3}{4}$ "	Light Tan or Light Green
<b>MARINE VENEER:</b> A strong, hard, flexible material in thin sheets, made of asbestos fiber and cement. A hard facing for Marinite-36 and Marinite-23, or used alone for sheathing of curved areas and as a ceiling material.	48" x 96" Tolerances: $\pm \frac{1}{32}$ " in length and width	$\frac{1}{8}$ ", $\frac{3}{16}$ " Tolerance: $\pm \frac{1}{32}$ "	Light-gray mottled appearance. Can be waxed or lacquered on the job
<b>MARINE FURRING (and INSULATING GROUNDS):</b> Strips or blocks cut from sheets of Marinite-65 for securement and insulating sheathing and ceiling panels from structural steel.	Widths, 2" thru 10" Lengths, thru 96" (as ordered)	1", 1 $\frac{1}{2}$ ", 2"	PP
<b>MARINE BATTENS:</b> Thin strips cut from sheets of Marine Veneer or Marinite-65. Used for molding, base and joint covering strips.	Widths, 2" thru 10" Lengths, thru 96" (as ordered)	Marine Veneer, $\frac{3}{16}$ " Marinite-65, $\frac{3}{8}$ ", $\frac{1}{2}$ "	Marine Veneer SBI
<b>REEFERITE:</b> A laminated panel of Marine Veneer and metal offering good structural strength plus low maintenance as a sanitary sheathing for refrigeration and food handling spaces. Also, when suitably erected, provides a long-life, incombustible ship's awning.	48" x 96", 48" x 84"	$\frac{3}{16}$ ", $\frac{1}{4}$ " (According to how laminated)	MAM, MZM, MA, MZ
<b>PERFORATED MARINE VENEER:</b> Sheets of Marine Veneer perforated with holes to permit passage of sound waves through separately erected acoustical absorbing element.	24", x 24", 24" x 48" (48" x 48" on special order)	$\frac{3}{16}$ "	Same as Marine Veneer Edges square or beveled
<b>MARINE ACOUSTICAL UNIT:</b> A rigid unit consisting of a Perforated Marine Veneer face securely fastened to a sound-absorbing mineral wool element.	24" x 24"	The unit is 1 $\frac{3}{4}$ " thick overall, with sound element cut back from edge $\frac{1}{4}$ " or 1 $\frac{5}{8}$ " as ordered. Edges can be squared or beveled.	
<b>BX-SPINTEX:</b> A semi-rigid mineral wool blanket for thermal and acoustical insulation. The blanket has a low conductivity and is furnished in different densities to meet Naval, Coast Guard and Maritime Administration requirements.	15", 20", 30" and 60" wide by 24" thru 60" long	Navy 340M (1" and 2" thick)—Faced with flame-proof muslin—meets Spec. MIL-I-15365B 3.25 lb Density (1" thru 5" thick)—meets Spec. MIL-I-16688B 3.5 lb Density (1" thru 5" thick)—meets Spec. 32-MC-1 (Maritime Adm.) 6 lb Density (1" thru 4" thick)—For fireproofing requirements U.S. Coast Guard—meets Spec. 32-MC-I (Maritime Adm.)	
<b>BX-MARINE BLOCK:</b> A rigid type of mineral wool for thermal and acoustical insulation.	24" x 36"	$\frac{1}{2}$ ", 1", 1 $\frac{1}{2}$ ", 2" also plied to 3" or 4"	15 lb per cu ft average density



**Description of Panel Finishes**

(In ordering, it is important that the desired panel finish be specified as indicated below: PP Finish; OO Finish, etc.)

- PP Finish—Plain untreated surface. Suitable as core for veneering or protective painting after sizing.
- OO Finish—Surface impregnated and baked. Suitable as core for veneering or protective painting without sizing.
- SBI Finish—Surface impregnated and baked both sides plus sanded glaze filler one side.
- SB2 Finish—Surface impregnated and baked both sides plus sanded glaze filler both sides.
- MO Finish—Marine Veneer (0.086" thick) one side, other side surface impregnated and baked.
- MM Finish—Marine Veneer (0.086" thick) both sides.
- MAM—Two faces of  $\frac{1}{8}$ " Marine Veneer laminated to an interposed core of 0.032" aluminum.
- MZM—Same as MAM above except the core is 24 ga. galvaneal steel.
- MA—One face of  $\frac{3}{16}$ " Marine Veneer laminated to one face of 0.032" aluminum.
- MZ—One face  $\frac{3}{16}$ " Marine Veneer laminated to one face of 24 ga. galvaneal steel.
- Wood Veneer—Each face consists of two,  $\frac{1}{28}$ " plies (a cross band and the face finish).
- (a) Select Wood Veneer both sides (Walnut, Mahogany, Oak, Gum, Maple, Limba, etc.).
- (b) Select Wood Veneer one side, unselected wood back for painting or Marine Veneer back.
- NOTE: Unselected wood finish on hidden side of a lining panel does not meet U.S. Coast Guard requirements.
- Metal Faces—(a) Aluminum (0.025" thick) both sides for painting. (b) Steel (24-ga. galvaneal) both sides for painting.
- NOTE: Consideration should be given to the corrosion hazard before specifying metal faces for marine service. In general, inert Marine Veneer will serve without fear of corrosion.
- Plastics and Plasticized Materials—Provide a wide variety of patterns and colors. Furnished both sides, or on one side with Marine Veneer other side for balance.
- CAUTION—Because of warpage hazard, panels with veneers one side only should be used only where the panel is to be secured to a back up of rigid furring.

**Average Weights of Panel Types normally used**

Overall Thickness	Type of Finish	Weight, lb per sq ft			
		Marinite-36	Marinite-23	Marinite-65	Reeferite
$\frac{3}{8}$ "	Standard Base 1 side (SB1)	—	—	2.22	—
$\frac{1}{2}$ "	Standard Base 1 side (SB1)	1.80	—	2.92	—
$\frac{1}{2}$ "	Aluminum 1 side	2.06	—	—	—
$\frac{1}{2}$ "	Galvaneal Steel 1 side	2.80	—	—	—
$\frac{9}{16}$ "	Wood Veneer 1 side	2.00	—	—	—
$\frac{5}{8}$ "	Marine Veneer 1 side (MO)	2.74	—	—	—
$\frac{5}{8}$ "	Marine Veneer 2 sides (MM)	3.36	—	—	—
$\frac{3}{4}$ "	Standard Base 2 sides (SB2)	2.57	—	—	—
$\frac{3}{4}$ "	Marine Veneer 2 sides (MM)	3.73	—	—	—
$\frac{7}{8}$ "	Standard Base 2 sides (SB2)	2.95	—	—	—
$\frac{7}{8}$ "	Marine Veneer 2 sides (MM)	4.11	3.34	—	—
$\frac{7}{8}$ "	Wood Veneer 2 sides	2.97	2.10	—	—
$\frac{7}{8}$ "	Wood V. 1 side, Marine V. 1 side	3.50	2.60	—	—
$\frac{7}{8}$ "	Aluminum 2 sides	3.46	2.52	—	—
$\frac{7}{8}$ "	Galvaneal Steel 2 sides	4.96	4.02	—	—
$\frac{1}{4}$ "	Marine Veneer 2 sides (MAM)	—	—	—	2.7
$\frac{1}{4}$ "	Marine Veneer 2 sides (MZM)	—	—	—	3.4
$\frac{3}{16}$ "	Marine Veneer 1 side (MA)	—	—	—	2.1
$\frac{3}{16}$ "	Marine Veneer 1 side (MZ)	—	—	—	2.8
For Crated LCL shipments, add approx.		20%	20%	15%	10%
		Marine Veneer	Perforated Marine V	Marine Acoustical Unit	
$\frac{1}{8}$ "	Natural Gray	1.1	—	—	
$\frac{3}{16}$ "	Natural Gray	1.7	1.6	—	
$\frac{13}{16}$ "	Natural Gray (Face)	—	—	3.0	
For crated LCL shipments, add approx.		12%	15%	20%	

Note: For rail shipments, minimum uncrated weight is 10,000 lb.

**Working and Finishing Panels**

The following details are general in scope. Complete directions appear on separate data sheets.

Cutting: Marinite and Marine Veneer, except where metal-faced, can be cut with ordinary wood-working carpenters' or power saws. However, carbide-tipped

power saws or steel-centered abrasive wheels reduce time and cost of cutting. A steel-cutting band saw is used for cutting metal-faced sheets. Drilling is usually done with steel-working twist drills.

Painting: Chlorinated Rubber, Interior Oleoresinous, or Latex Paints can be used in accordance with the paint manufacturer's directions.



### Recommendations

The recommendations given in the following table cover the general usage of J-M Marine Joiner Panels where only normal service abuse is to be encountered

and decorative painting is used for final finishing. Special decorative effects were described under "Table of Finishes," preceding. For abnormal surface abuse see under "Typical Specifications" following.

Recommendation	Comments
<b>Divisional Bulkheads—</b> (1) Single: $\frac{7}{8}$ " Marinite-36 (2) Double: $\frac{1}{2}$ " Marinite-36 or $\frac{1}{2}$ " Marinite-65	Marinite-36 is the lightest material structurally strong enough in the $\frac{7}{8}$ " thickness for free-standing erection in panel sizes up to 48" x 120" with edge support only. For double bulkheads, to save weight, $\frac{1}{2}$ "-thick Marinite can be used only if intermediate support is provided in the center of the panel in addition to the support provided at each edge. For such bulkheads, if some additional weight is permissible, $\frac{1}{2}$ " Marinite-65 gives added strength.
<b>Linings—</b> (1) Separately erected (similar to single divisional bulkheads): $\frac{7}{8}$ " Marinite-36 (2) Secured to metal furring which is integral with frames and/or shell: $\frac{1}{2}$ " Marinite-65	When erected free-standing, the comments regarding Marinite-36 for single divisional bulkheads apply. When erected to furring which in turn is integral with the framing and/or the shell plating, the added strength of Marinite-65 has proved to be worthwhile assurance.
<b>Ceilings—</b> (1) Non-Acoustical: $\frac{3}{8}$ " Marinite-65 or $\frac{3}{16}$ " Marine Veneer (2) Acoustical: Perforated Marine Veneer Covering BX-Spintex or Marine Acoustical Units	<b>Non-Acoustical—</b> The $\frac{3}{8}$ " thickness permits deep beveling and deeper securement screw countersinking with consequent greater adhesive area for spackling. The painted finish of Marinite-65 is decoratively superior to Marine Veneer. <b>Acoustical—</b> The separately erected Perforated Marine Veneer sheathing BX-Spintex sound-absorbing blanket, provides flexibility of use (large size sheets up to 48" x 48") with fewer joints. However, the separately erected sound absorbing blanket (BX-Spintex) should be faced with flameproof muslin to prevent any possibility of sifting. . . . The Marine Acoustical Units provide an integral sound absorber and sheathing in smaller sizes (24" x 24" only).

### Typical Specifications

The tabular matter following includes essential information used in making up typical specifications for J-M Marine Joiner Materials. All thicknesses shown are

"overall," including any veneers. They apply to use aboard Passenger Ships, Cargo Ships, Tankers, Ore Carriers, etc. Sound-absorbent treatments mentioned apply particularly to passenger ships.

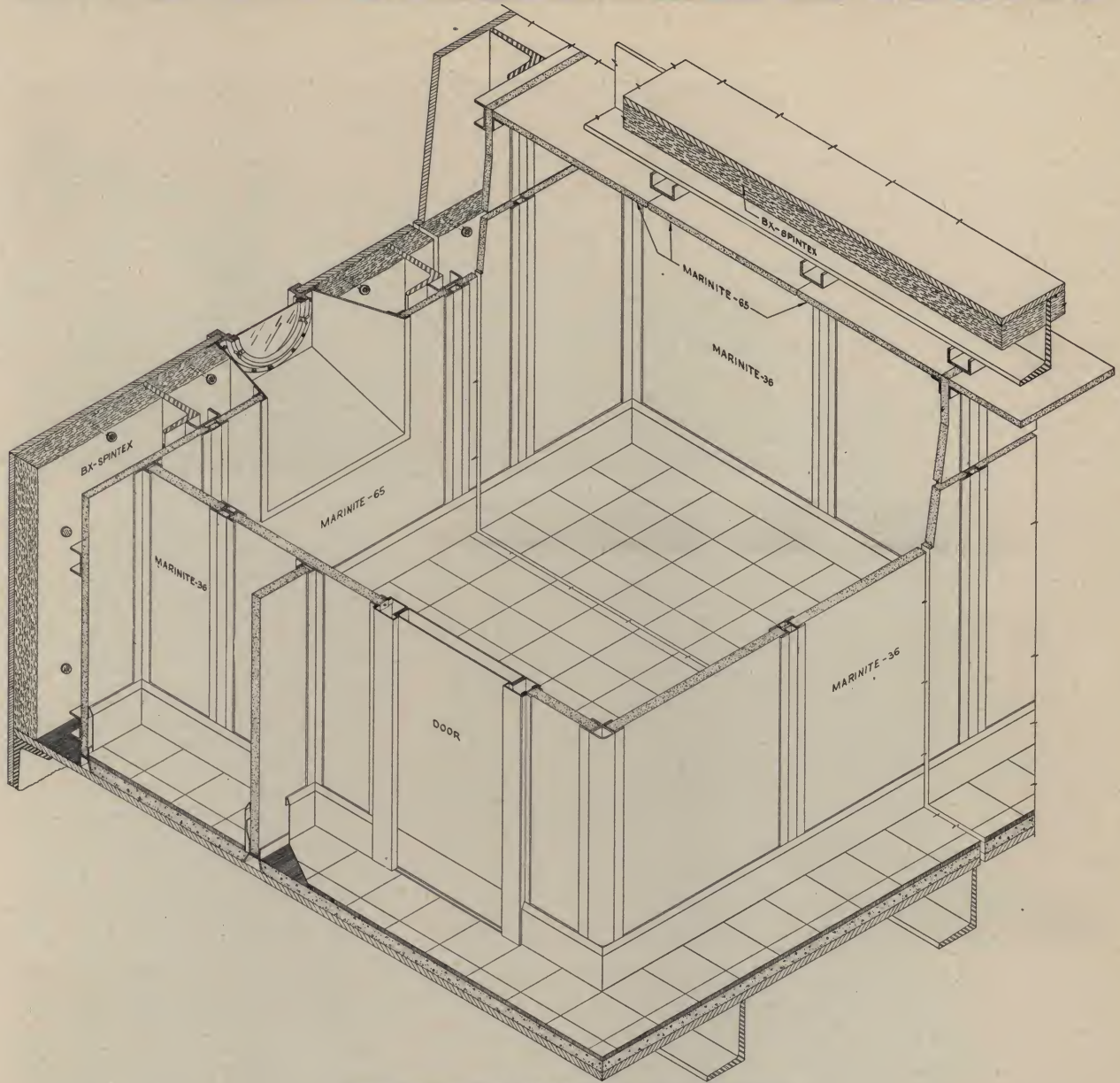
Type of Space	Joiner Bulkheads	Joiner Linings	Joiner Ceilings
Spaces Requiring Unusual Decorative Treatments	$\frac{7}{8}$ " Marinite-36 with wood veneer faces. Marine Veneer on corridor side of corridor bulkheads and stairway enclosures	$\frac{9}{16}$ " Marinite-36 with wood veneer on exposed face. Other side plain	$\frac{3}{8}$ " Marinite-65 or $\frac{3}{16}$ " Marine Veneer painted. . . . For noise abatement, $\frac{3}{16}$ " Perforated Marine Veneer backed by 2" BX-Spintex or Marine Acoustical Units
Spaces for Normal Use	$\frac{7}{8}$ " Marinite-36, painted	$\frac{1}{2}$ " Marinite-65, painted	$\frac{3}{8}$ " Marinite-65 or $\frac{3}{16}$ " Marine Veneer, painted
Spaces Subject to Hard Usage	$\frac{7}{8}$ " Marinite-36 with Marine Veneer finish two sides, waxed or painted	$\frac{5}{8}$ " Marinite-36 with Marine Veneer finish on exposed side, waxed or painted; or $\frac{1}{2}$ " Marinite-65, painted	$\frac{3}{8}$ " Marinite-65 or $\frac{3}{16}$ " Marine Veneer, painted
Spaces Needing Sound-Absorbent Treatment	To isolate sound of Radio Rooms, Fan Rooms, etc., walls and ceilings are lined with 4" BX-Spintex and sheathed with Perforated Marine Veneer		

### Typical Joiner Construction

The drawing shown on the following page is typical of J-M Marine Joiner Construction: Marinite-36 for

divisional bulkheads; Marinite-65 secured to metal furring for linings and ceilings; and BX-Spintex for insulation.





*Illustrating typical J-M Marine Joiner construction*

### Glossary of Marine Terms

**Bulkhead:** A term applied to any of the partition walls used for subdividing the interior of a ship into the various compartments.

**Camber:** The upward curvature of ship's decks from one side to the other both for drainage and strength purposes.

**Deckhead:** Overhead areas of a space or room.

**Fore and Aft:** That part of the ship which goes from one end toward the other as "fore and aft bulkhead."

**Lining:** An interior finishing or sheathing material over the ship's structure.

**Reefer:** A shortened form of the word "refrigerator," as "reefer spaces" are refrigerated rooms.

**Sheer:** The lengthwise curve of a ship's decks.

**Shell:** The plating forming the outer skin of a vessel.

**Space:** An enclosed area aboard ship such as a state-room, refrigerated room, engine room, etc.

**Stiffener:** A structural metal shape such as an ell or a tee for strengthening bulkheads and decks.

**Transverse:** That part of the ship going from one side toward the other as "transverse bulkhead."

**Uptake:** A conduit usually of sheet metal connecting the boiler smokebox with the base of the smokestack.



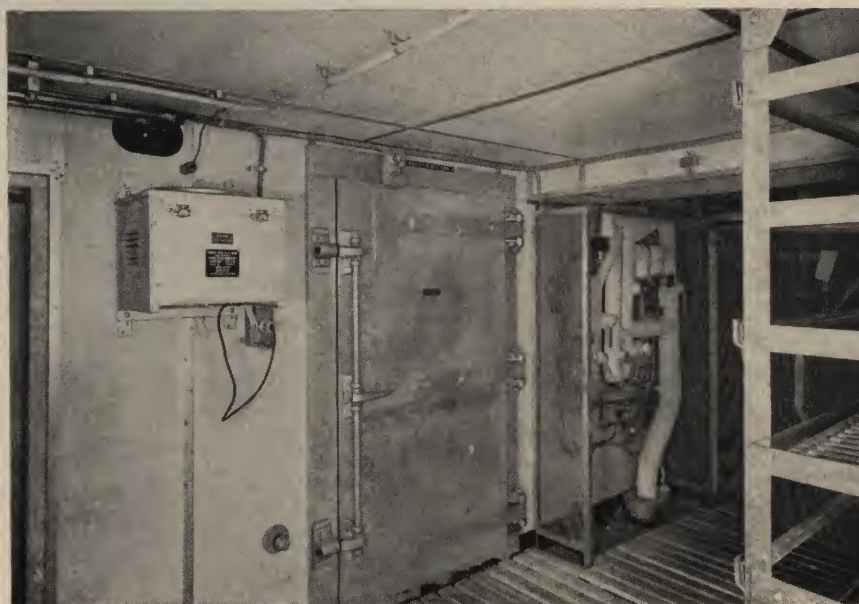
*Typical Marine Joiner Installations*

*Pilot House with Marinite for bulkheads and ceiling*

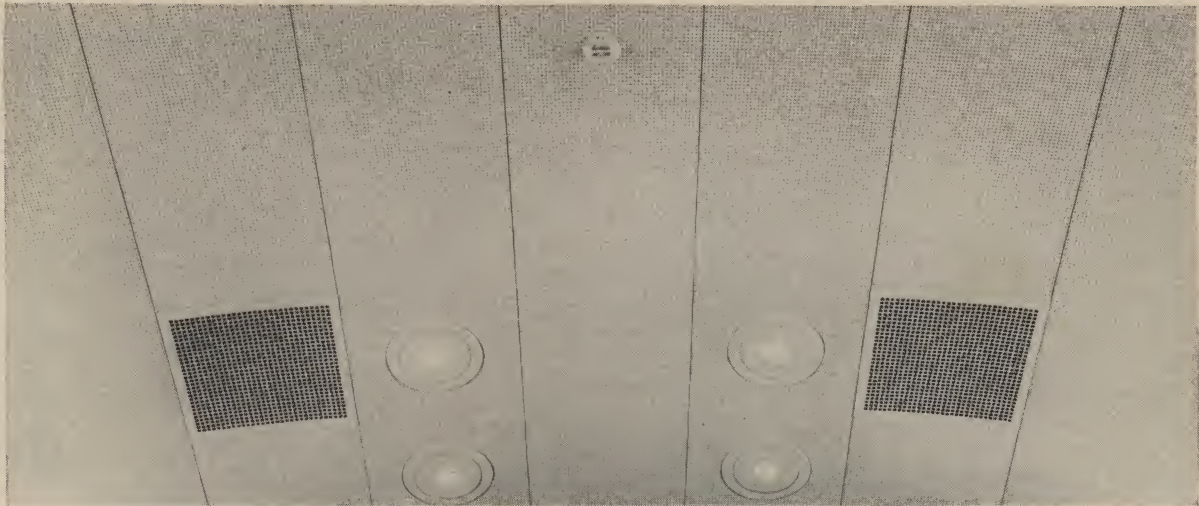


*The bulkhead linings of this stateroom consist of Marinite faced with wood veneer*

*Reeferite was used for sheathing this refrigerated cargo space*







*Perforated Marine Veneer, adaptable to curved as well as flat surfaces, is the facing used for this J-M acoustical ceiling in a public space of a large passenger ship*

### Sound Control or Noise Quieting

Johns-Manville, as one of the original pioneers in the solution of sound-control problems, has developed various techniques and materials to meet the requirements of noise quieting aboard ships. In general, the problems of noise-quieting can be classified by the following conditions:

Sound-absorbing treatments for the reduction of human noises originating within staterooms, lounges, etc. Quieting here is commonly done by applying noise absorption treatment to the ceilings or walls. Acoustical treatment placed overhead in a bar or lounge lowers the noise level, permitting easier and more audible con-

versation. Conversational noise between adjacent cabins is also largely a function of the weight per square foot of the intervening joiner bulkhead. Double-wall (hollow) bulkheads are slightly better than a single bulkhead of equal weight provided the two sides are not connected by the posts or throughout the panels.

The lining of ventilating ducts and plenum with a sound-absorbent and similarly lined "sound trap" boxes on each side of fans are essential treatments. Radio rooms, and similar noisy spaces are absorption-lined or ceiled to reduce the general noise level and promote audibility.

Quieting of a space from an exterior noise requires some degree of Noise Isolation. For example, a state-room below a cargo-handling deck could be effectively quieted by dampening the deckhead of the accommodations with a J-M mineral wool insulating material (BX-Spintex) and installing a tight, solid ceiling on Tension-Type Rubber Isolators. Also, the boundary joiner bulkheads of the space can be erected with Compression Type Isolators. Quarters below a fan room can be similarly treated.

In addition, structural insulations often serve for noise-quieting as well as for thermal insulation. Machinery casing insulation, for example, when applied on the machinery side and sheathed with steel becomes a sounding board which actually amplifies the machinery noise. However, if this same thermal insulation is provided with a sheathing of Perforated Marine Veneer or perforated metal to permit the absorption of sound, a considerable noise reduction is obtained without any sacrifice of insulating value.



*J-M Marine Acoustical Units provide noise-quieting treatment combined with thermal insulation in the engine room*



## Structural Insulations

Johns-Manville BX Insulations are exceptionally efficient materials which afford the most practical means of insulating adequately, without excessive weight, all types of ships. Faced with Perforated Marine Veneer to permit passage and trapping of sound, the insulations provide noise quieting in addition to thermal insulation.

As listed in the preceding table, "Summary of J-M Marine Joiner Materials and Structural Insulations," Johns-Manville BX Insulations include BX-Spintex and BX-Marine Block.

### Insulation Recommendations:

Marine structural insulation involves (1) "comfort" and equipment (refrigerator space) insulation; (2) U. S. Coast Guard requirements for "fire protection" insulation for Class A-60, A-30 and A-15 bulkheads or decks. A third phase enters where "noise quieting" insulation is specified, as the same materials are approved and used for all three conditions. Thus, except in refrigerated spaces in making an insulation layout, it is advisable to first determine for any location whether the ship's specifications or the Coast Guard regulations require the greater thickness.



Installing BX-Spintex Insulation in the pilot house of a Lake's Carrier

The recommendations shown in the following table are for comfort insulation, air-conditioning, heating, etc., for usual marine conditions. Abnormal service or conditions will, of course, require special treatment.

While conditions usually require the insulation to be placed between beams, frames or stiffeners, the protruding steel, unless completely insulated, substantially reduces the over-all efficiency of the insulation. The

### General Recommendations for Average Practice\*

Type of Construction and Sheathing Used	Recommended Insulation Thickness
<b>Insulation for Underside of Decks (Between Beams)</b>	
Exposed metal deck with 2" wood deck covering:	
(a) with $\frac{3}{8}$ " non-metallic joiner ceiling below . . . . .	None
(b) with Marinite-36 gasketed, metal ceiling below . . . . .	1½"
Exposed metal deck without wood deck covering:	
(a) with $\frac{3}{8}$ " non-metallic joiner ceiling below . . . . .	3"
(b) with metal ceiling and ½" Marinite-36 gaskets on flanges . . . . .	4"
Note: If decks are over an air-conditioned space, add 1" to thicknesses given.	
Deck over machinery space . . . . .	4"
Deck over galley (metallic ceiling in galley) . . . . .	4"
Deck under galley (non-metallic joiner ceiling in space below) . . . . .	3"
Deck between air-conditioned and non air-conditioned spaces . . . . .	2"
<b>Insulation for Shell and Bulkheads (Between Frames or Stiffeners)</b>	
Shell of ship or exposed steel bulkheads:	
(a) when lined with $\frac{7}{8}$ " Marinite-36 independent of frames . . . . .	2"
(b) when lined with ½" Marinite-65 furred to frames . . . . .	3"
(c) when metal-sheathed, ½" Marinite-36 gasket on flanges . . . . .	4"
(d) when metal-sheathed, no insulating gasket on flanges . . . . .	5"
Machinery casing (½" gaskets)—insulation on machinery side . . . . .	4"
Metal partition bulkheads . . . . .	3"
Metal bulkheads with ½" Marinite-65 lining . . . . .	1½"
Galley bulkheads to air-conditioned spaces . . . . .	4"
Air-conditioning ducts (exterior insulation, vapor-sealed) . . . . .	1"

\* J-M Fire-Screen Bulkhead and Deck Treatments meeting U. S. Coast Guard Regulations are shown on separate data sheets.



curves here shown (from Van Dusen's studies at the Bureau of Standards) clearly demonstrate how the normally expected heat transmission is doubled or even trebled by complete steel enclosure of the insulation—such as installed in machinery casings.

It is therefore essential that metal sheathing over insulation be furred or gasketed off ( $\frac{1}{2}$ " Marinite-36 or equal gasket) from the stiffeners, beams or frames.

Where conditions permit, insulation on the plate (non-stiffener) side of a bulkhead or deck is much more effective than insulating between stiffeners. Also, insulating across or below beams (with a composite or rigid type of insulation) is much more effective. Based on actual two-hour, fire-protection tests of deck structures, protected only with a Marinite-36 ceiling, the U. S. Coast Guard regulations for an A-60 deck protection gives equal approval to  $1\frac{1}{8}$ " Marinite-36 installed below the beams as to 3" of insulation between the beams plus a  $\frac{3}{8}$ " joiner ceiling.

### Typical Specifications

The following table includes typical information required in specifying J-M Structural Insulations.

Purpose of Insulation	J-M Material To Be Specified
Fire Control	Johns-Manville Mineral Wool, blanket type BX-Spintex of 6 lb per cu ft density
Temperature Control	Johns-Manville Mineral Wool, blanket type BX-Spintex of 3.5 lb per cu ft density
Sound Control	Johns-Manville Mineral Wool, blanket type BX-Spintex of 3.5 lb per cu ft density. For noise "isolation" the insulation to have a J-M Felt interposed between the blankets. . . . For noise "absorption" (ceilings, etc.), the 3.5 lb density BX-Spintex with flameproof muslin faces is to be sheathed with J-M Perforated Marine Veneer panels.

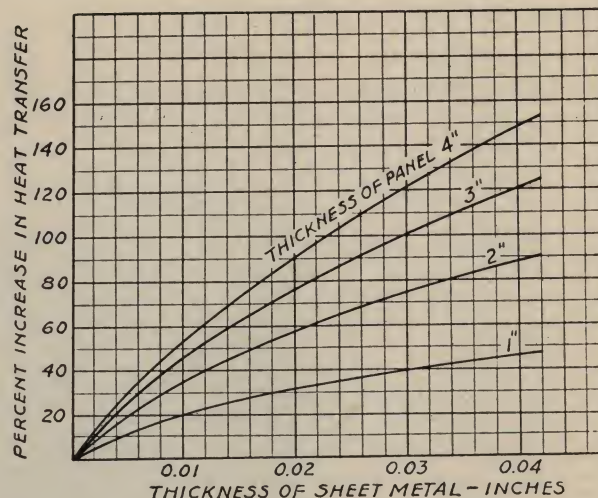
### Installation

The following details concerning the installation of Deck, Shell and Bulkhead insulations are general in scope. More complete details appear on separate data sheets.

Insulation placed between the beams, frames or stiffeners, or on the plate side is commonly secured by:

(a) Nelson pins or studs (with attached head) driven through the insulating material on approximately 12" centers.

(b) Welding wire studs to the plating and then im-



Percent increase in heat transfer through 40" by 40" panel due to complete steel enclosure, illustrates necessity of an insulating gasket to break up heat flow. The heat loss through the metal is essentially constant irrespective of the thickness of the panel, while the heat loss through the insulated portion decreases with increased thickness. Therefore, for a thick, insulated metal-encased panel, the heat loss through the metal will be a larger proportion of the total heat loss than for a thinner panel

paling the insulation on the studs and securing with "speed clip" washers.

(c) Welding "U" clips of wire to plating, impaling the insulation and securing with a  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " 18-gage galvanized clip, drilled to receive the wires which are twisted for final securement.

In all cases, the insulations must be carefully "snugged" (not compressed) into place so that the installed insulation will retain its original density. Linings are installed over suitably arranged furring as a facing over insulation and stiffeners.

### Refrigerated Space Insulation

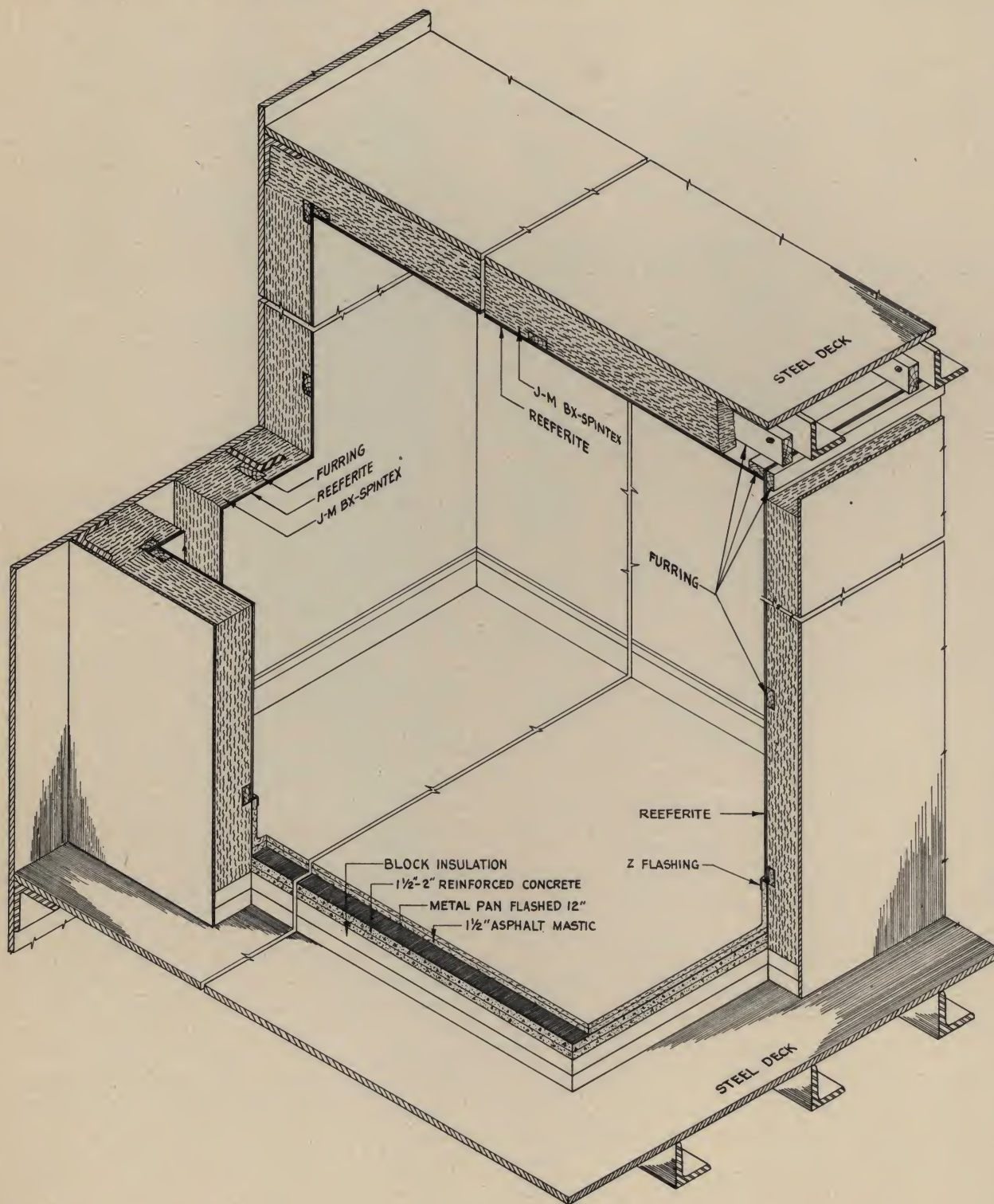
For obvious reasons, the insulating of refrigerated cargo and stores spaces aboard ship attains greater significance than shore installations of similar nature. For, in addition to the usual normal insulation efficiencies expected, conditions such as varying and sudden climatic changes plus unpredictable stresses and strains demand that the insulation and its protective sheathing be extremely rugged.

With respect to economical operation, the insulation of refrigerated equipment and structures is especially important. A ton of refrigeration, for example, costs approximately ten times as much as the equivalent number of Btu when produced for heating purposes.



The J-M materials used for refrigerated space insulation (reefer spaces) are Reeferite, BX-Spintex and BX-Marine Block as previously described. The Reeferite serves as a lining or sheathing; BX-Spintex for

insulating ceilings and walls in back of the Reeferite lining; and the BX-Marine Block for decks or floors. The drawing below illustrates typical construction methods.





## Banroc Blankets

Where the convenience of a flexible insulation is desired, Banroc® Blankets may be employed. This insulation has been found suitable for industrial baking ovens, dryers, ducts and breechings and similar equipment. Banroc Blankets are adaptable for curved surfaces and do not break in handling. They are easily cut on the job to fit around obstructions and irregular equipment. The blankets may be used under normal conditions for temperatures to 1000 F.

The blankets are composed of a felted, spun mineral-wool fiber secured between various types of metal fabric, asbestos paper or other finishes, depending upon service requirements. The density and thickness of the blanket are carefully controlled to assure full insulation value. The weight of the felts in the standard blanket is 0.75 lb per sq ft, 1" thick, with a tolerance of plus 15 percent and minus 10 percent.

Advantages of the felted, spun mineral-wool filler are as follows:

1. Higher strength and body improves "handleability" . . . fibers will not dislodge around the edges.
2. More uniform fiber orientation results in uniform thickness and prevents light and heavy spots.
3. Cleaner.
4. Firmer and squarer blanket edges, both as furnished and as cut on the job.
5. Lighter in weight.

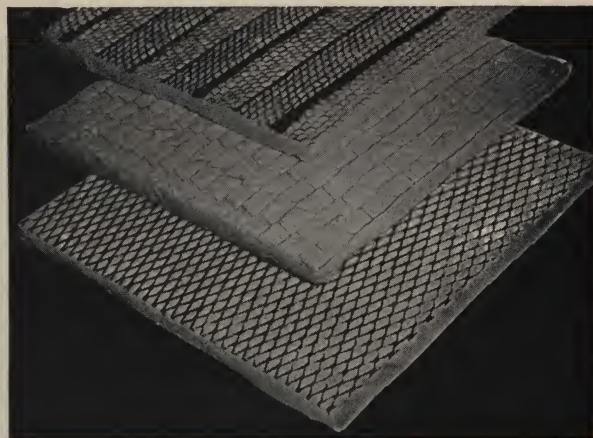
### Types and Sizes

Standard types of blankets are indicated in the table of styles and metal fabrics following; other than standard styles can also be furnished. The standard metal fabrics used are Copper-Bearing Metal Lath, Stucco Lath, Rib Lath and Galvanized Wire Mesh.

Galvanized Wire Mesh (1") is of the straight-line type. Galvanized Hexagonal Mesh Wire (1") can be substituted when the straight-line type is not available.

Copper-Bearing Metal Lath (also known as Burial-Vault Mesh) weighs approximately 2.5 lb per sq yd with  $\frac{9}{16}$ " x  $\frac{7}{8}$ " between centers of diamonds. Diamond Mesh Lath (which can be substituted when Copper-Bearing Metal Lath is not available) weighs approximately 2.5 lb per sq yd with  $\frac{3}{8}$ " x  $\frac{9}{16}$ " between centers of diamonds.

Stucco Lath weighs approximately 1.8 lb per sq yd with  $1\frac{3}{8}$ " x 3" between centers of diamonds.



Banroc Blankets, showing at top, rib lath; center, wire mesh; bottom, metal lath

Rib Lath ( $\frac{3}{8}$ ") weighs approximately 3.0 lb per sq yd and Rib Lath ( $\frac{3}{4}$ "), approximately 5.4 lb per sq yd.

Sizes: Banroc Blankets are furnished in standard sizes, 24" x 96" and 24" x 48", except Style No. 182, which is furnished 24" x 48" in thicknesses up to and including  $3\frac{1}{2}$ ", and 24" x 24" in the 4" thickness. Standard blanket thicknesses are 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ ",  $1\frac{3}{4}$ ", 2",  $2\frac{1}{2}$ ", 3",  $3\frac{1}{2}$ ", 4",  $4\frac{1}{2}$ ", 5",  $5\frac{1}{2}$ " and 6".

Standard types of Banroc Blankets

Style No.	Metal Fabric
102	1" galvanized wire mesh on both sides
103	Stucco lath on both sides
112	Copper-bearing metal lath and 1" galv. wire mesh
113	Stucco lath and 1" galvanized wire mesh
122	Copper-bearing metal lath on both sides
123	Stucco lath and copper-bearing metal lath
132	$\frac{3}{8}$ " rib lath and 1" galvanized wire mesh
132-A*	Same as No. 132 except ribs are turned out
142	$\frac{3}{8}$ " rib lath and copper-bearing metal lath
142-A*	Same as No. 142 except ribs are turned out
143	$\frac{3}{8}$ " rib lath and stucco lath
143-A*	Same as No. 143 except ribs are turned out
152	$\frac{3}{4}$ " rib lath and 1" galvanized wire mesh
152-A*	Same as No. 152 except ribs are turned out
153	$\frac{3}{4}$ " rib lath and stucco lath
153-A*	Same as No. 153 except ribs are turned out
162	$\frac{3}{4}$ " rib lath and copper-bearing metal lath
162-A*	Same as No. 162 except ribs are turned out
172**	$\frac{3}{8}$ " rib lath on both sides
182***	Asbestos paper on both sides
192	No. 12 mesh fly-screen on both sides

NOTE: Under each style number, the first metal fabric listed is the side on which wire staples are twisted. When the twisted ends are required on the reverse side, it must be so specified.

\* On this type of blanket, the turned out rib provides an air space, where such is desired.

\*\* Ribs may be turned in or out, and run lengthwise or across the blanket, or at right angles to each other, as specified.

\*\*\* Asbestos twine, in single-tied stitches, is used in place of wire staples.



**Banroc Blankets Heat Transmission**

Btu per square foot per hour

Insulation thickness (including ½" cement finish), inches	Temperature of surface, F												
	100	150	200	250	300	350	400	500	600	700	800	900	1000
	Temperature difference between surface and air, F												
	25	75	125	175	225	275	325	425	525	625	725	825	925
1½	6.85	21.2	36.3	52.2	68.9	86.4	105	144	186	233	283	340	403
2	4.93	15.2	26.3	37.8	50.2	63.0	76.7	106	138	173	212	254	302
2½	3.88	12.0	20.8	29.9	39.8	50.1	61.1	84.6	110	139	170	204	243
3	3.20	9.98	17.1	24.9	32.9	41.5	50.4	69.7	91.4	115	141	171	204
3½	2.70	8.40	14.5	21.0	27.9	35.2	42.9	59.5	77.7	98.1	121	146	175
4½	2.10	6.53	11.3	16.3	21.6	27.2	33.2	45.9	60.4	76.9	95.0	116	138
5½	1.70	5.25	9.13	13.1	17.6	22.0	27.0	37.4	49.4	62.5	76.9	93.2	112
6½	1.43	4.43	7.63	11.2	14.9	18.7	22.8	31.5	41.5	52.5	65.3	80.0	96.2

**Banroc Blankets—Number of Blankets and Weight per Carton**

(Note—1¼", 1½" and 2¼" thicknesses are packaged as the next larger size)

Style No.		Thicknesses of 24" x 96" Blankets											Thicknesses of 24" x 48" Blankets										
		1"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	1"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"
102	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	10	8	6	5	5	4	4	3	3
	Wt. lb.	202	189	183	187	177	153	174	195	143	157	171	151	142	153	150	133	128	145	130	143	118	128
103	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	245	218	204	205	191	164	185	205	151	164	178	183	163	154	164	144	137	154	137	151	123	134
112	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	238	214	202	202	189	163	183	204	150	163	177	179	160	160	162	142	136	153	136	150	122	133
113	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	223	204	194	196	184	159	179	200	147	161	175	167	153	146	157	138	132	149	133	147	121	131
122	Bkt. per ct.	11	8	6	5	4	3	3	3	2	2	2	18	12	10	8	6	5	5	4	4	3	3
	Wt. lb.	252	238	220	218	201	172	192	213	156	169	183	206	179	183	174	151	143	160	142	156	127	137
123	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	260	228	212	211	196	168	188	209	153	167	181	195	171	159	169	147	140	157	139	153	125	135
132	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	252	223	209	208	194	166	187	207	152	166	179	189	167	157	167	146	138	124	138	152	124	135
132-A	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	16	11	8	7	6	5	5	4	4	3	3
	Wt. lb.	210	195	174	167	194	166	187	138	152	166	179	168	153	139	146	146	138	124	138	152	124	135
142	Bkt. per ct.	11	8	6	5	4	3	3	2	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	265	248	227	223	206	175	196	144	158	171	186	217	186	170	179	143	146	163	144	158	129	139
142-A	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	16	10	8	7	5	5	4	4	3	3	3
	Wt. lb.	241	217	189	179	206	175	196	144	158	171	186	193	155	151	156	129	146	131	144	119	129	139
143	Bkt. per ct.	11	8	6	5	4	3	3	2	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	274	238	219	217	201	171	192	142	155	169	183	205	178	165	174	151	143	160	142	117	127	137
143-A	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	16	10	8	7	5	5	4	4	3	3	3
	Wt. lb.	228	208	182	174	201	171	192	142	155	169	183	182	148	146	152	126	143	128	142	117	127	137
152	Bkt. per ct.	10	7	6	5	4	3	3	2	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	264	216	226	223	206	175	195	144	158	171	185	216	185	170	178	154	146	163	144	118	129	139
152-A	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	16	10	8	7	6	5	4	4	3	3	3
	Wt. lb.	264	216	189	178	206	175	195	144	158	171	185	192	154	151	156	154	146	130	144	118	129	139
153	Bkt. per ct.	10	7	6	5	4	3	3	2	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	283	228	237	232	213	180	201	148	161	175	189	232	196	178	186	160	150	167	148	121	131	142
153-A	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	14	9	8	7	5	5	4	4	3	3	3
	Wt. lb.	283	228	198	185	213	180	201	148	161	175	189	180	147	158	162	133	150	134	148	121	131	142
162	Bkt. per ct.	10	7	6	5	4	3	3	2	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	297	237	245	238	218	184	205	150	164	178	191	243	203	184	191	164	153	171	150	123	133	144
162-A	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	14	9	8	7	5	5	4	4	3	3	3
	Wt. lb.	297	237	204	191	218	184	205	150	164	178	191	189	153	163	167	136	153	136	150	123	133	144
172	Bkt. per ct.	10	7	5	4	4	3	3	2	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	253	225	195	183	211	179	199	147	160	174	188	227	193	176	183	158	149	166	147	120	131	141
182	Bkt. per ct.	...	...	...	...	...	...	...	...	...	...	...	18	12	9	8	6	5	10*	...	...	...	...
	Wt. lb.	...	...	...	...	...	...	...	...	...	...	...	154	144	139	152	134	129	146*	...	...	...	...
192	Bkt. per ct.	12	8	6	5	4	3	3	3	2	2	2	18	12	9	8	6	5	5	4	4	3	3
	Wt. lb.	215	199	190	193	182	157	177	198	146	159	173	161	149	143	154	136	131	148	132	146	120	130

\* Furnished 24" x 24" only.



## Zerolite Sheets and Lagging



Zerolite\* is a low-temperature insulating material manufactured from mineral wool and a resin binder, processed so that the resin binder is dispersed over the mineral wool fibers. The result is an insulation with exceptional moisture resistance. Zerolite is also fire resistant and immune to attack or damage by organic solvents such as benzol, methyl ethyl ketone, and petroleum fractions and derivatives.

Such outstanding qualities make this material particularly applicable in the oil and chemical industries for insulating such equipment as:

Petroleum Dewaxing  
Gas Purifiers and Condensers  
Chillers and Exchangers  
Pharmaceutical Processes  
Reactors and Economizers

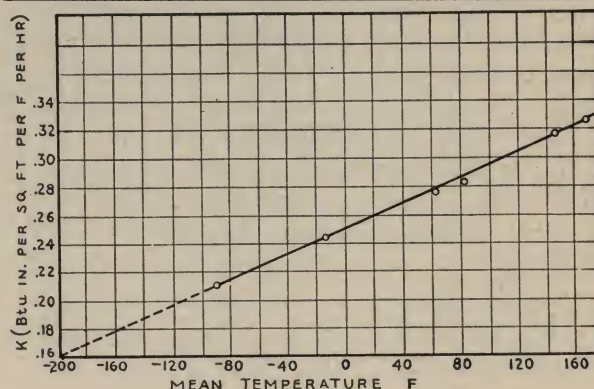
Solvent Storage  
Cold Tanks and Vessels  
Brine Coolers  
Air-Conditioning Ducts  
Fur Storage Rooms

The low conductivity of Zerolite is due to the interlacing of the mineral fibers causing innumerable minute dead-air cells. The resistance to moisture, which is an outstanding characteristic of Zerolite, is an important factor in maintaining its original low conductivity in service. The accompanying chart and table summarize the characteristics of this product.

\* Reg. U. S. Pat. Off.

### Properties

Cohesive strength, psf . . . . .	300
Compression (500 psf load), inches . . . . .	0.030
Water absorption (submerged 24 hr) % by volume, max. . . . .	2.0
Moisture absorption (air, 75% rel. humid., 96 hr), % . . . . .	0.0
Temperature limit, F . . . . .	-400 to + 250
Modulus of rupture, psi . . . . .	40
Thermal conductivity . . . . .	(See chart)
Combustibility . . . . .	Fire resistant
Average weight, lb per cu ft . . . . .	15.0
Specific heat . . . . .	0.30
Coefficient linear change with temperature . . . . .	$2.0 \times 10^{-6}$



Zerolite Thermal Conductivity Chart

### ZEROLITE SHEETS AND LAGGING

June, 1951 (Cancelling sheet dated April, 1950)

IN-76





*Insulkote being troweled on 2"-thick Zerolite sheets insulating fresh air duct in engine room*

### Sizes and Types of Zerolite

Zerolite sheets are furnished in the following standard sizes and thicknesses: 18" x 36", in 1½", 2", 3" and 4" thicknesses; 18" x 18" in 1" thickness. The sheets weigh approximately 1.3 lb per sq ft per inch of thickness. Discs are furnished from 1½" to 4" thick up to 18" diameter; in two pieces, to 36".

Zerolite lagging is furnished in thicknesses of 1½", 2", 3" and 4", in lengths of 18" (36" on order) and widths from 2" to 6". However, on special order, Zerolite sheets in thicknesses of 2", 3" and 4" can be scored on 2", 3" and 4" centers as specified. Such scored sheets eliminate the need for lagging on moderate-sized tanks and vessels.

Zerolite pipe insulation and Zerotex fitting insulation, for cold piping, are described elsewhere on separate data sheets.

### Applying Zerolite

The application of low-temperature insulation of any type involves more care than is common with insulation against heated surfaces. With low temperatures, the insulation must not only be permanently water-proofed but must also be sealed against the infiltration of moist air which in time would condense and destroy its insulating value.

**Interior Work:** It is standard practice to use hot asphalt for the adhesion of Zerolite to surfaces of cold

rooms. Portland cement mortar can be used but it does not provide the moisture-proofing needed. Suitable cold adhesives can also be used.

For adhesion to surfaces of tanks, either hot asphalt or a cold adhesive can be used. On small tanks and vessels where lagging is used it is preferable to apply the lags dry under a spring band, the last lag slightly oversize and forced into place to tighten all joints.

Lags and sheets on vessels and tanks must be secured with galvanized or rust-resistant steel strapping and clips, or other approved mechanical support.

The finish over Zerolite in rooms depends upon the construction used and expected service: When Zerolite is applied against wood framing or constructed as a self-supporting partition, the finish should be portland cement plaster; when applied in asphalt against concrete or good, solid brickwork, the finish may be either portland cement plaster, Insulkote or Zerokote\*—the plaster where abrasion or rubbing against the walls may be expected, and Insulkote or Zerokote if the room is to be frequently hosed and washed. Regardless of the finish used, Zerolite sheets should first receive a coat of J-M Insulkote Primer.\*\*

**Exterior Work:** On outdoor tanks the recommended finish is ⅛" Aertite coating on the primed Zerolite followed by an Asbestocite† casing. Alternates to the Asbestocite casing are Double Coated Flexstone banded in place, or Insulkote with two coats of aluminum paint.

\* Zerokote is a job-mixed finish consisting of 35 percent (or lb) Zerokote Emulsion, 45 percent (or lb) plaster's sand, 20 percent (or lb) of J-M No. 302 Cement and about 4 gal (33 lb) of Water. The sand and cement are mixed dry and then mixed with the Zerokote Emulsion to which 2½ gal of water has been added. More of the water is added slowly until a good troweling consistency is obtained. Too much water should be avoided. Insulkote is furnished ready-mixed for immediate application.

Note: Formula for Zerokote Emulsion may vary on Pacific Coast.

\*\* J-M Insulkote Primer is used for priming Zerolite sheets. It has a covering capacity of about 100 sq ft per gal.

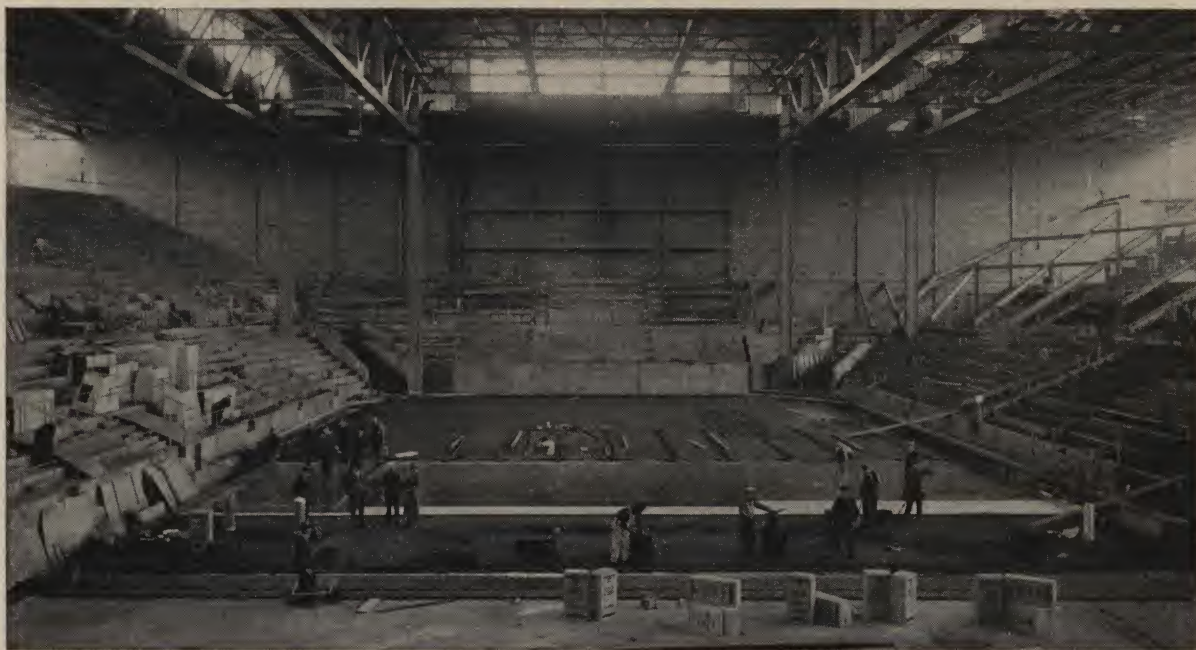
† J-M Asbestocite (asbestos-cement board product).



*Zerolite is a particularly efficient insulation for outdoor tanks*



# Rock Cork Sheets and Lagging



*For over ten years, the double layer of 2" Rock Cork sheets laid in this large arena has resisted the strains set up by massed formations in hockey and the dead weight of heavy exhibits*

Rock Cork\* is a low-temperature insulation composed principally of mineral wool combined in production with an asphaltic binder, molded into sheet form and baked. The insulation is especially recommended for refrigeration service in the food and beverage industries and other low temperature work.

The exceptional success of Rock Cork, used since 1908 as an insulation for all kinds of cold-storage construction, is largely due to its retention of low conductivity at low service temperatures; freedom from offensive odors; effective sealing against moisture and air penetration; immunity to termites, vermin and mold; structural strength and ease of working on the job.

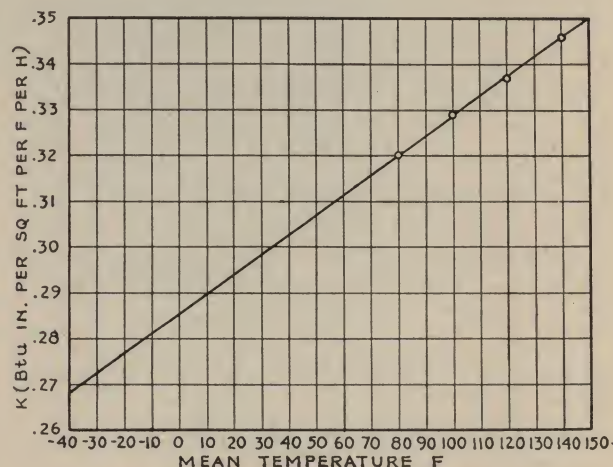
Cohesive strength, psf . . . . .	400
Compression (500 psf load), inches . . . . .	0.030
Water absorption (submerged 24 hr) % by volume, max. . . . .	3.0
Moisture absorption (air, 75% rel. humid., 96 hr), % . . . . .	0.7
Temperature limit, F . . . . .	-400 to + 150
Modulus of rupture, psi . . . . .	30
Thermal conductivity . . . . .	(See chart)
Average weight, lb per cu ft . . . . .	15.0
Specific heat . . . . .	0.27
Coefficient linear change with temperature . . . . .	$4.5 \times 10^{-6}$

\* Reg. U. S. Pat. Off.

## Properties and Characteristics

The accompanying table of properties and chart, showing the thermal conductivities, further illustrate the qualities which are responsible for the continued wide use of Rock Cork in industry.

The resistance to moisture, which is a marked characteristic of Rock Cork, is an important factor in maintaining its original low conductivity in service. Exami-



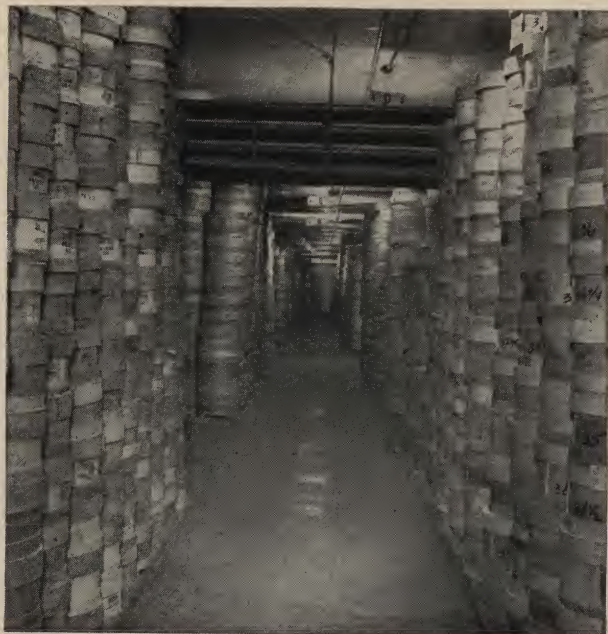
*Rock Cork Thermal Conductivity Chart*

## ROCK CORK SHEETS AND LAGGING

June, 1951 (Cancelling sheet dated October, 1941)

IN-80





*Rock Cork-Insulated Cheese Storage Room*

nation of a number of installations with an average of 17 years in use showed a moisture pick-up of 1.1 percent average, with no instance of more than 2 percent. This low moisture absorption adds to the longevity of the construction and thus increases the economy effected by the use of Rock Cork.

Owing to the asphaltic binder, Rock Cork furnishes an ideal base for an asphaltic adhesive or finish, assuring an air and moisture-resistant seal.

The firm structure of Rock Cork sheets permits ready handling and installing in any type of construction. It has, however, sufficient compressibility to follow slight irregularities of the surface to be insulated, eliminating voids between the insulation and the wall.

All materials used in the manufacture of Rock Cork are odorless, and the most sensitive food products will not absorb offensive odors from this material. It will not harbor rats, insects or vermin of any kind, nor is it subject to attack by termites. Extensive tests have demonstrated that Rock Cork will not, under any conditions, support the growth of bacteria or mold.

The fibrous nature of Rock Cork permits absolutely tight joints, not possible with the granular edges of other material.

### **Sizes and Types of Rock Cork**

J-M Rock Cork sheets are furnished in the following standard sizes and thicknesses: 18" x 36", in thicknesses of 1", 1½", 2", 3" and 4". Other sizes,

within these limitations, and intermediate thicknesses can be furnished on special order. The sheets weigh about 1.25 lb per sq ft per inch of thickness, uncartoned.

The sheets are available scored in the 2", 3" and 4" thicknesses. Saw cuts are approximately half the thickness of the sheet on 2", 3" or 4" centers, as ordered.

Rock Cork in lagging form for curved surfaces such as columns is made to accommodate diameters from 14" to 20 ft, and is supplied 18" long (or 36" on order) in thicknesses of 1½", 2", 3" and 4", and from 2" to 6" wide, depending on the diameter. The outside diameter of tank or equipment to be insulated must be specified.

Flat discs are furnished in 1½", 2", 3" and 4" thicknesses in one piece up to 18" diameter; and in two pieces for larger diameters up to 36".

Rock Cork is also manufactured in granular form for use where an insulation which can be poured into place is desired. Granulated Rock Cork should be packed to a density of 12 to 14 lb per cu ft. Furnished in bags containing approximately 40 lb.

Where hand packing, rather than pouring, is required to fill irregular spaces, Zerofil is recommended. It is an asphalt-treated loose mineral wool which is especially convenient for packing around ice-making tanks, etc. Zerofil should be packed to a density of approximately 10 lb per cu ft. Shipped in bags containing approximately 40 lb.

Rock Cork Pipe Insulation and Zerotex Fitting Insulation, for pipe lines carrying refrigerated fluids, are described on other data sheets.



*Rock Cork-Insulated Fruit Storage Room*

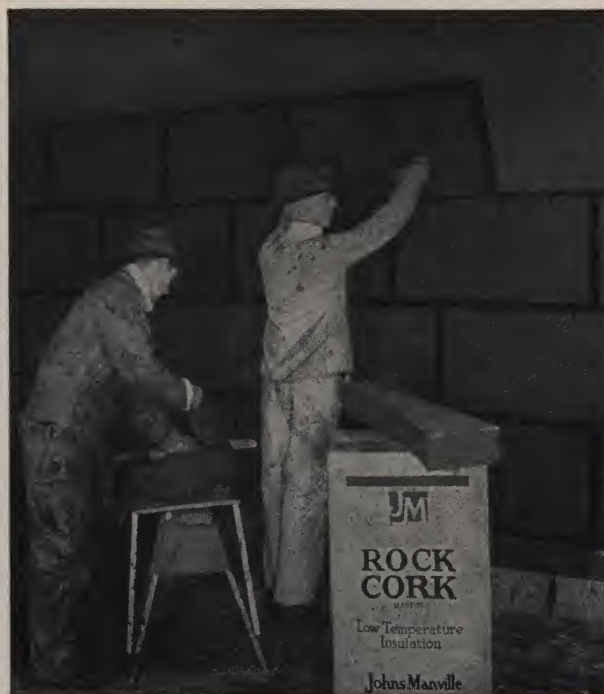


### Uses for J-M Rock Cork

J-M Rock Cork in sheet and lagging form is used as a standard cold insulation for any form of cold storage construction or refrigerating equipment. Rock Cork has a record of successful service in meat freezers and coolers, quick freeze rooms and equipment, ice cream hardening rooms, ice storage rooms and ice manufacturing tanks, fruit and vegetable storages, air-conditioning equipment, rooms and equipment for the dewaxing of lubricating oils, brine coolers, indoor and outdoor cold tanks including much specialized equipment such as gas purifier boxes. Careful inspection of jobs insulated with J-M Rock Cork as far back as 1908, show the material to be in perfect condition after these many years of service.

### Applying J-M Rock Cork

The application of low-temperature insulation of any type involves more care than is common with insulation against heated surfaces. With low temperatures, the insulation must not only be permanently waterproofed but must also be sealed against the infiltration of moist air which in time would condense and destroy its insulating value. While portland cement may be used for adhesion of Rock Cork, asphalt has the distinct advantage of providing waterproof



*Rock Cork sheets provide an ideal base for asphaltic adhesives and finishes, helping to assure an airtight, waterproof seal*



*Rock Cork-Insulated Beer Storage Room*

construction, a most important feature in applying any low temperature insulation. Asphalt also sets much quicker than portland cement plaster, making possible more rapid application. J-M Rock Cork Asphalt is prepared especially for this work.

The finish over Rock Cork depends upon the type of construction used and expected service: When Rock Cork is applied against wood framing or constructed as a self-supporting partition, the finish should be portland cement plaster; when applied in asphalt against concrete or good, solid brickwork, the finish may be either portland cement plaster, Insulkote or Zerokote\*—the plaster where abrasion or rubbing against the walls may be expected, and Insulkote or Zerokote if the room is to be frequently hosed and washed. Regardless of the finish used, the Rock Cork sheets should first receive a coat of a suitable primer.

\* Zerokote is a job-mixed finish consisting of 35 percent (or lb) Zerokote Emulsion, 45 percent (or lb) plasterer's sand, 20 percent (or lb) of J-M No. 302 Cement and about 4 gal (33 lb) of Water. The sand and cement are mixed dry and then mixed with the Zerokote Emulsion to which 2½ gal of water has been added. More of the water is added slowly until a good troweling consistency is obtained. Too much water should be avoided.

Zerokote should not be used when the temperature is likely to exceed 100 F nor for a finish on insulation exposed to direct action of the weather.



J-M Rock Cork is applied in accordance with the specifications which have been developed and found sound during many years of experience with this material on all kinds of refrigeration work. The application of Rock Cork by J-M Insulation Service Units is made in accordance with these specifications.

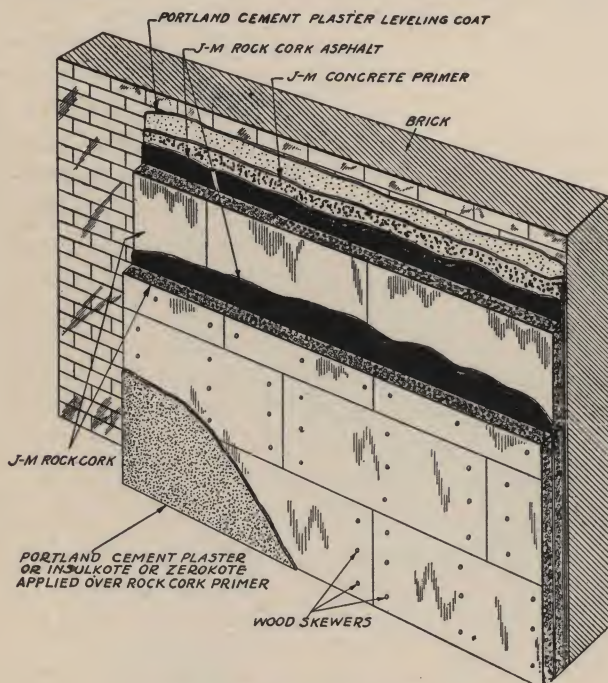
### Thicknesses Recommended

While many factors, such as the cost of refrigeration, and local atmospheric and temperature conditions, may govern the amount of insulation which should be used, the thicknesses of sheets or lagging given in the following table are recommended for general requirements:

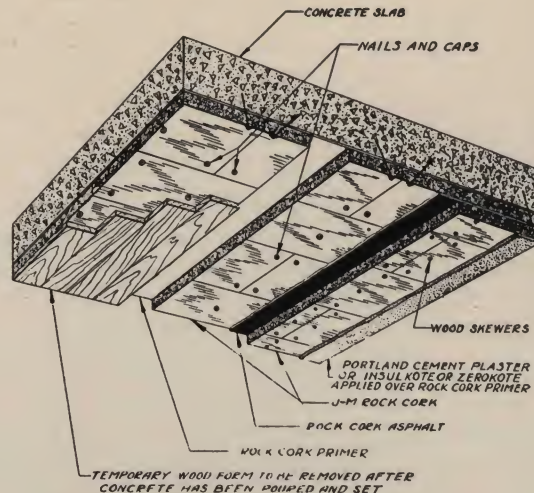
Temperature range, F	Thickness
-60 to -40	12"—Three layers
-40 to -25	10"—Three layers
-25 to -15	8"—Two layers
-15 to 0	7"—Two layers
0 to 15	6"—Two layers
15 to 25	5"—Two layers
25 to 35	4"—One or two layers
35 to 45*	3" or 2"—Single layer

\* Suitable thickness of insulation at this higher temperature range generally depends on other factors more than temperature difference. Among these factors are cost of refrigeration, surface temperature and dew point.

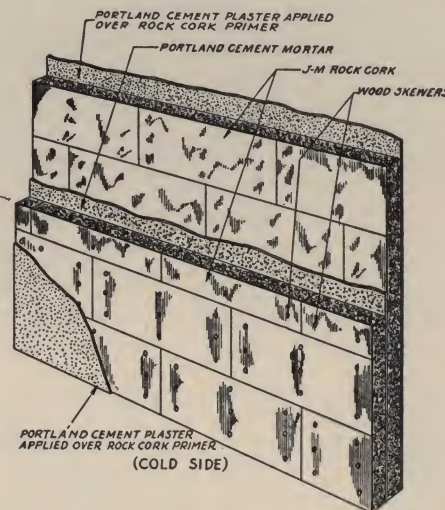
In the use of low-temperature insulation in loose or granular form, it is customary to employ twice the thickness recommended for sheets or lagging.



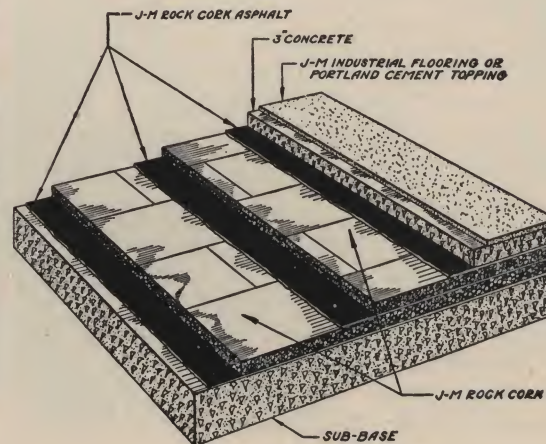
Rock Cork on rough masonry wall



Rock Cork construction for ceiling insulation



Solid Rock Cork partition



Rock Cork floor insulation



## J-M Asbestos Millboard

Johns-Manville Asbestos Millboard is a dense, hard sheet or board product formed under high pressure from a homogeneous mixture of asbestos fibers and various binding materials. The color of J-M Millboard is a natural light gray.

Asbestos Millboard is recommended for applications which require a sheet or board insulation for protection against fire, heat, acid fumes, and similar applications. It is frequently used as a fire-resistant lining for floors, partitions, ceilings, stoves and grates. Millboard is also used for many industrial purposes.

The sheets can be sawed or sheared to any desired size and easily fastened in place with nails or screws.

All of the following grades of J-M Millboard are furnished in standard size sheets, 42" x 48", and thicknesses from  $\frac{1}{32}$ " through  $\frac{1}{2}$ ". Cut pieces can also be supplied.

### No. 106 Millboard:

This grade is most commonly used and is suitable for the majority of conditions where millboard is required. It will withstand temperatures up to approximately 800 F.

### No. 102 Millboard:

This is a higher quality material than No. 106 in grade of asbestos fiber and heat resistance. It will withstand temperatures up to approximately 1000 F.

### "C" Grade Millboard:

This millboard contains an especially long grade of asbestos fiber and is used for a great many conditions where a board of unusual heat-resisting properties is required. It is generally suitable for temperatures up to 1200 F. Although at higher temperatures it becomes somewhat brittle, "C" Grade has been successfully used for conditions subject to temperatures as high as 1800 F where brittleness was not a serious objection.

### No. 219 Millboard:

This is a particularly high grade millboard, specially treated to give it somewhat greater density and strength. No. 219 is principally used for gaskets on hot oil, gas and tar lines, oil stills, etc. While generally suitable for temperatures up to 1500 F, it can be used



*Laying J-M Millboard over Superex blocks between side walls and brick pier in base of a still*

up to 1800 F where some loss of strength is not a serious objection.

### Silicated Millboard:

All grades of millboard mentioned can be furnished with a treatment which increases the surface hardness for conditions requiring an especially hard sheet, such as used by glassworkers. Where such sheets are required, the order should specify the word "Silicated" before the millboard type.

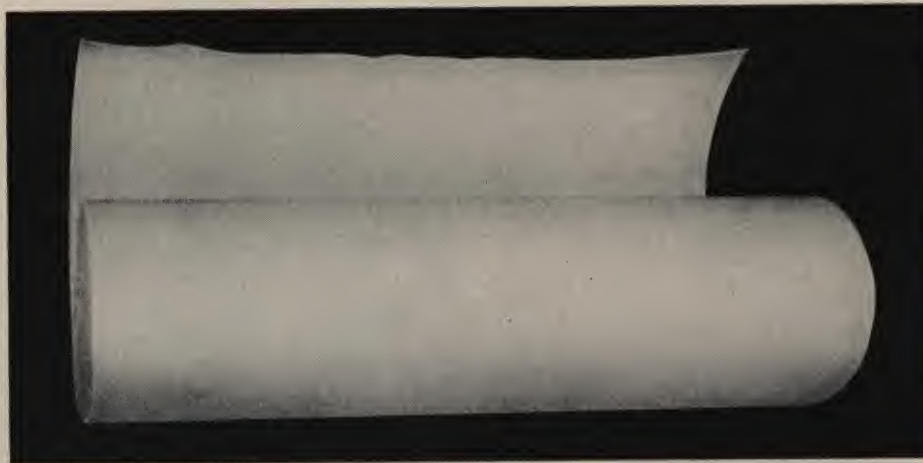
### Average Unpackaged Weights and Tolerances

Thickness, inches	Tolerance, inches $\pm$	*Lb per sheet, 42" x 48"	*Oz per sq ft
$\frac{1}{32}$	0.007	2.5	2.9
$\frac{3}{64}$	0.008	3.5	4.0
$\frac{1}{16}$	0.008	4.6	5.3
$\frac{5}{64}$	0.008	6.0	6.9
$\frac{3}{32}$	0.009	7.0	8.0
$\frac{1}{8}$	0.014	9.0	10.3
$\frac{5}{32}$	0.015	11.3	12.9
$\frac{3}{16}$	0.016	13.3	15.2
$\frac{1}{4}$	0.025	17.6	20.1
$\frac{5}{16}$	0.029	21.4	24.4
$\frac{3}{8}$	0.034	25.2	28.8
$\frac{1}{2}$	0.045	32.5	37.1

\* Actual weights may vary plus or minus 10 percent.



## J-M Asbestos Paper and Roll Board



J-M Asbestos Paper and Roll Board are intended for use where an insulating material of minimum thickness is required.

Asbestos Paper is used principally in the manufacture of corrugated insulation in various forms. It is also used as a dielectric in electrical appliances; as a base to provide a smooth surface for sewed-on canvas jackets over pipe insulation; and as a wrapping for furnace and heater pipes, although for the latter purpose, Asbestocel in flexible roll form is more efficient.

Asbestos Roll Board, thicker than Asbestos Paper, is used as a protection against heat or as a fire retardant between walls, floors and ceilings, and in the manufacture of gaskets, protective pads, etc. Asbestos Paper may also be used for these purposes.

A 12-lb Asbestos Paper Tape is available in standard rolls 84-ft long in 2" and 3" widths, 18 and 12 rolls per package, respectively.

J-M Asbestos Paper and Roll Board are furnished in 25, 50 and 100-lb rolls. Standard widths of Asbestos Paper are 18", 24", 36" to 37½" and 72"; Roll Board, 18", 36" and 72". Other weight rolls, other widths and cut sheets may also be ordered.

Special asbestos papers for various industrial uses requiring uniformity and purity not found in commercial grades are listed in the table below. For special applications or conditions not shown, consult the nearest Johns-Manville office.

*Special Asbestos Papers\**

Name	Use	**Thickness, inches	Weights of rolls, lb
Special Long Fibre Asbestos Paper	Used for electrolytic-cell diaphragms in manufacture of chlorine and caustic soda by electrolysis.	0.006 through 0.0625	100
Long Fibre Asbestos Paper	Used as a dielectric in motors and equipment subject to heat.	0.006 through 0.0625	100
Asbestos Welding Paper	Used to protect adjacent parts against heat, smoke and odors.	0.0625	50, 100
Doublex Asbestos Paper (10-lb weight only)	Used as templates and permanent record of glass characters in neon-sign manufacture and for pouring gates or funnels in foundries.	0.023	50, 100

\* Actual thickness of Paper may vary plus or minus 0.003"; Roll Board, plus or minus 0.020".

\*\* Actual weights may vary plus or minus 10 percent.

\* All papers in this table are furnished in standard width of 36".

\*\* Actual thickness may vary plus or minus 0.002" for thicknesses through 0.010"; plus or minus 0.003" for thicknesses from 0.015" to 0.030"; plus or minus 0.004" for thicknesses of 0.030" and over.

*Asbestos Paper*

Approx thickness,* inches	Approx weight** per 100 sq ft, pounds
0.015	6
0.019	8
0.022	10
0.027	12
0.029	14
0.032	16
0.0625	32

*Asbestos Roll Board*

¾	48
⅜	64



## Asbestos Roll Fire-Felt

*For temperatures to 1000 F*

J-M Asbestos Roll Fire-Felt\* is adaptable to a wide variety of uses because of its great flexibility and its insulating and heat-resisting properties. It is a soft felt of asbestos fiber that may be folded, bent or wrapped around pipes and heated surfaces.

It is especially adapted, either in roll or strip form,

for use in furnace expansion joints. Also utilized to wrap pipes where space does not permit the application of sectional insulation.

Asbestos Roll Fire-Felt is furnished in thicknesses of  $\frac{3}{32}$ ",  $\frac{1}{8}$ ",  $\frac{3}{16}$ " and  $\frac{1}{4}$ ", in rolls 36" wide containing 100 sq ft. Indented material will be furnished unless otherwise specified on order.



### *Approximate Weights*

Thickness, inches	Pounds per sq ft
$\frac{3}{32}$	0.50
$\frac{1}{8}$	0.60
$\frac{3}{16}$	0.93
$\frac{1}{4}$	1.25

## Ceilinite

*For temperatures to 1000 F*

Ceilinite is used as an interlining in steel cars, in fireproofing electrical apparatus, such as switch boxes, and for similar services demanding a strong, flexible, fireproof felt. It is made from Asbestos Roll Fire-Felt, reinforced on one side only with asbestos cloth.

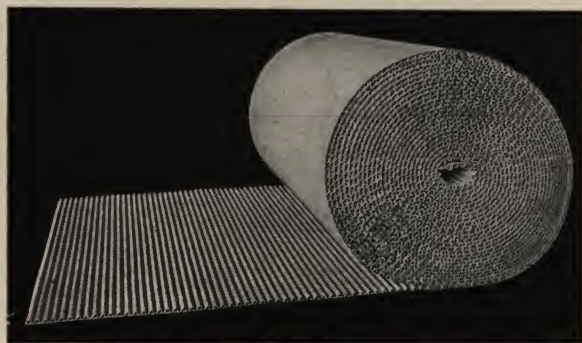
Furnished in rolls 36" wide in  $\frac{1}{8}$ " and  $\frac{1}{4}$ " thicknesses, 100 sq ft to the roll. Approximate weights are 0.7 lb per sq ft for the  $\frac{1}{8}$ " thickness, and 1.3 for the  $\frac{1}{4}$ " thickness.



## Asbestocel in Flexible Roll Form

*For temperatures to 300 F*

Asbestocel\* in Flexible Roll Form is particularly adapted to insulating hot air heater casings and furnace pipes.



\* Reg. U. S. Pat. Off.

This material is made by fastening together a plain and a corrugated asbestos felt into a single sheet, approximately  $\frac{1}{4}$ " thick. It is applied by wrapping one or more times around the pipe to be insulated and fastening with spirally wound wire. Additional fastening should be provided by wire rings placed about every 18". At least two layers of Asbestocel should be applied on warm air furnace pipes.

To provide a neater finished appearance, Asbestos Paper may be pasted over the surface of the Asbestocel after it has been wired on.

Furnished in rolls 36" to 37" wide, containing approximately 125 or 250 sq ft. Shipping weight, in cartons, about 44 lb for 250-sq ft rolls. Also furnished fine corrugated,  $\frac{1}{16}$ " thick, in 125 or 250-sq ft rolls.



## J-M Standard Hair Felt

*For temperatures below 200 F*



J-M Standard Hair Felt is used for the insulation of fittings on cold water pipes insulated with Anti-Sweat, Zero and Pre-Shrunk Wool Felt. It is also used in J-M Built-up Brine and Ammonia Insulation, J-M Built-up Hair Felt Insulation and for miscellaneous insulating purposes.

Detailed specifications for the use of Hair Felt under various conditions appear in other data sheets.

J-M Standard Hair Felt is made from 100% selected cattle hair by an improved felting process. It is furnished in bales 3, 4½, 6 and 9-ft wide by 50-ft long. The 6-ft size may be furnished in two pieces and the 9-ft size in three pieces, without cutting charge, provided

all pieces are taken. For all other sizes there is an additional cutting charge. Available thicknesses are shown in the table.

*Approximate Weights*

Thickness, inches	Weight per sq ft, ounces	Weight per bale of 300 sq ft, pounds	Weight per bale of 150 sq ft, pounds
¼	3¾	63	33
½	6	105	53
¾	8¾	147	75
1	11	190	95
1½	16	283	143
2	21	379	190

## Banroc Board

*For temperatures to 225 F*

Banroc\* Board is a light-weight insulation composed of blended mineral wool which is formed with a moisture-resisting binder into rigid sheets, brown in color. This material was especially developed for the conservation of heat, control of temperature and elimination of condensation in heating, ventilating and air-conditioning ducts and equipment. Banroc Board is also a desirable insulation for oil storage tanks, dryers and for general moderate temperature service where moisture conditions make the use of other materials unsuitable.

\* Reg. U. S. Pat. Off.

Banroc Board may be used under continuous temperatures up to 225 F. When it is exposed to fire, it will not smolder nor support combustion. In moisture-resistance tests conducted under a relative humidity of 90 percent at a temperature of 93 F, the material showed a gain in weight of approximately 2 percent after twenty-four hours. Continued exposure for seven days thereafter caused no further increase.

The material is furnished in sheets, 24" x 36", in thicknesses of ½", 1", 1½" and 2". Also available in plied thicknesses of 3" and 4". Banroc Board has a density of approximately 1¼ lb per sq ft, 1" thick.



# Asbestocel Jackets for Range Boilers

## Vertical and horizontal types

The Asbestocel\* Jacket for range boilers is highly effective in keeping hot water hot. It is attractive in appearance, easily applied and surprisingly low in cost. This range boiler jacket is made with the same moisture-resistant asbestos felts used in the manufacture of J-M Pre-Shrunk Asbestocel Pipe Insulation; it consequently eliminates objectionable shrinkage troubles and maintains indefinitely its initial high insulating efficiency. Asbestocel Jackets are available to fit both vertical and horizontal boilers.

### Description

The standard jackets are made up in three-ply construction, each of the plies being composed of a plain and a corrugated asbestos felt fastened together and

approximately  $\frac{1}{4}$ " thick. The jackets are furnished in two full-round sections, each section being one-half the length of the boiler. The sections are slit longitudinally and silicated for a distance of approximately 3" back from the slit edges. The corrugations are pressed flat for a sufficient distance from the outer edges of the sections, usually about 2", to assure a satisfactory fit over the boiler rivets. Asbestocel-Jackets for horizontal boilers are slightly longer than the jackets used for the vertical type when boiler ends are insulated with Asbestocel Discs instead of with insulating cement.

Standard 3-ply jackets are available for boilers of 30, 40, 52, 66, 82 and 100-gal capacities. A large number of other sizes of Asbestocel Jackets, as well as thicknesses up to 10 plies ( $2\frac{1}{2}$ " thick), may be obtained on special order.

**Finish:** J-M Asbestocel Jackets are supplied with a white glazed finish, or a clean asbestos paper finish. Either may be painted if desired to match or contrast with adjacent surfaces.

**Accessories:** With jackets for vertical range boilers, four pounds of J-M No. 352 Insulating Cement are included in each carton to provide for insulating the top of the boiler. Three 2"-wide bands for concealing the center and end joints and ten staples to facilitate application are furnished with each vertical range-boiler unit.



*Asbestocel Jackets are highly effective*



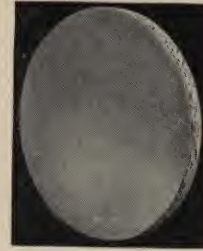
*Applying the top section of an Asbestocel Jacket to vertical boiler. Note bottom section held in place with quick-fastening staples. The finished job is shown above, at right*

\* Reg. U. S. Pat. Off.

### Dimensions and Shipping Weights

Boiler capacity gallons	Jacket Diameter, inches	Jacket length, inches	Extra length for discs, inches	Approx. shipping weight, lb
30	12	60	1½	21
40	14	60	1¾	23
52	16	60	2	25
66	18	60	2½	27
82	20	60	2¾	30
100	22	60	3¾	33



**Asbestocel Jackets for Range Boilers — (Continued)**

*A horizontal boiler jacketed with Asbestocel insulation and optional Asbestocel Disc. The discs improve appearance and result in saving of labor otherwise required for application of cement*

With jackets for horizontal boilers are included five 2"-wide bands and ten staples. The ends of horizontal boilers may be insulated with J-M No. 352 Insulating Cement in the same manner as vertical boiler tops, or Asbestocel Discs may be used. The discs improve the appearance of the finished job and effect a considerable saving in labor. Orders for horizontal type jackets should specify whether the discs or insulating cement are desired. Such orders should also indicate the shell length, over-all length and the diameter of the boiler.

Each jacket, together with accessories, is packed in an individual carton.

Rapid application is one of the outstanding features of the J-M Asbestocel Jacket. The jacket is quickly fixed in place with staples. Furnishing the jacket in two half-lengths makes for easier handling. Full directions are included with every unit.

**Fuel Savings Possible Through Use of Asbestocel Jacket**

Range Boiler	Annual Heat Loss Btu	Coal Loss Per Year, lb	Oil Loss Per Year, gal
Bare	33,800,000	5020	386
3-Ply Jacket	8,510,000	1262	97

Assumed Conditions: 30-gal standard range boiler. Water temperature, 170F. Surrounding air temperature, 70F. Boiler efficiency 50 percent. Heating season, 8760 hours.



## J-M Pipe Insulation

Johns-Manville furnishes many kinds of insulation in a form suitable for insulating pipes conveying hot or cold liquids and gases. The particular insulation which should be selected depends on the individual requirements of the installation.

J-M 85% Magnesia, used extensively for insulating steam and other heated piping, combines high insulating value and light weight. The 85% Magnesia produced by the J-M process has a great number of voids or minute dead-air cells which increase its natural resistance to heat transmission and reduce its weight. This material, moreover, affords maximum mechanical strength consistent with high insulating efficiency. It is used for temperatures to 600 F.

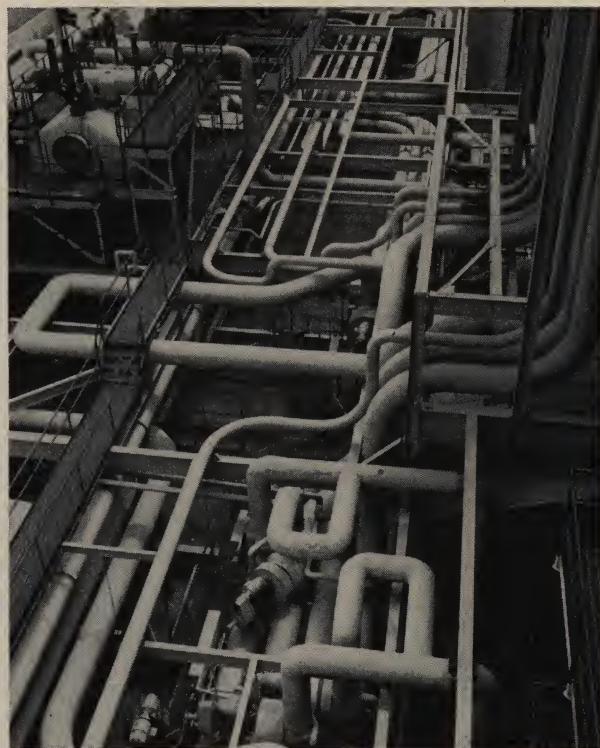
Asbesto-Sponge Felted is a most efficient insulation for pipes conveying hot fluids or vapors at temperatures to 700 F. Its high insulating value is due to its construction, which contains many surface resistances greatly reducing the transfer of heat through the material. Being constructed to withstand rough service and mechanical abuse, it can be removed and replaced many times without loss of insulating value.

In the range of temperatures above those recommended for 85% Magnesia or Asbesto-Sponge Felted, Superex Pipe Insulation should be used. Superex is often used as an inner layer in combination with 85% Magnesia or Asbesto-Sponge Felted, combining the greater insulating efficiency of these materials with the high heat resistance of Superex. These combinations of Superex and 85% Magnesia or Asbesto-Sponge Felted are known as Superex Combination Insulation.

Generally speaking 85% Magnesia, Asbesto-Sponge Felted, Superex or Superex Combination will solve any ordinary insulation problem on heated pipes, but other materials are available and may frequently be used to advantage. More complete information on these materials and on other pipe insulations for cold piping appears in the insulation data sheets.

Following, are brief descriptions of J-M Pipe Insulations.

**Anti-Sweat Pipe Insulation:** Made of laminated insulating felts protected from the infiltration of moisture by waterproofing felts on the inner and outer surfaces of each layer. Used for temperatures down to 45 F to insulate cold water pipes and to prevent condensation. Furnished in 3-ft sections, to fit standard pipe sizes and straight runs of copper tubing, in thick-



*An effective installation of J-M pipe insulation on heated lines exposed to all kinds of weather*

nesses of  $\frac{1}{2}$ " and  $\frac{3}{4}$ " single layer construction, and 1",  $1\frac{1}{2}$ " and 2" double layer.

**Asbesto-Sponge Felted Pipe Insulation:** Made of felts composed of asbestos fiber so combined to give a spongy laminated material. Withstands rough usage, and can be removed and reapplied without loss of insulating value. Furnished in 3-ft sections from 1" to  $2\frac{1}{2}$ " thick single-layer; over  $2\frac{1}{2}$ " thick, two layers. Also supplied to fit straight runs of  $\frac{3}{8}$ " to 6" copper tubing. Can be supplied with weatherproof or water-permeable jacket. Temperature limit 700 F.

**Asbestos Fire-Felt Pipe Insulation:** Moulded from felted asbestos fiber. Used where insulation must resist vibration and mechanical abuse. Furnished in 3-ft sections, 1" to 3" thick, to fit standard pipe sizes. Temperature limit 1000 F.

**Asbestos Pipe Blankets:** For pipes, fittings and flanges where inspection is made frequently and necessitates removal of the insulation. Made of asbestos cloth, filled with asbestos fiber and tufted. Furnished 2" or 3" thick in single layer, and each layer  $1\frac{1}{2}$ " or 2" thick, in double layer. Made in 3-ft sections with 1-ft sections for breaking joints on double-layer con-



struction. Temperature limit up to 850 F depending upon type of cloth used.

**Banroc Pipe Insulation:** Made of mineral wool in two types: Style No. 25, with metal lath inside and outside for use where an asbestos weatherproof jacket or cement finish is desired; Style No. 65, made with a 24-ga. rust-resisting iron outer casing, with 2" end lap, to provide a weatherproof and fireproof jacket. Furnished in 2-ft sections, 1" to 4" thick, for pipe sizes of 2" and larger. Temperatures to 1000 F under normal conditions.

**Built-up Brine and Ammonia Pipe Insulation:** Built-up on the job by using several layers of 1" hair felt thoroughly sealed with a waterproofing membrane. Used on pipes carrying low-temperature liquids or gases.

**Built-up Hair Felt Pipe Insulation:** Built-up on the job by using the required number of layers of 1" hair felt secured to the pipe with jute twine and finished on the outside with a weatherproofing jacket. Used to protect water lines from freezing.

**85% Magnesia Pipe Insulation:** One of the most efficient commercial insulations. Made of 85% basic carbonate of magnesia bonded with asbestos fiber. Furnished to fit standard pipe sizes in 3-ft sections or segments in the following thicknesses: Standard, 1½", 2", 2½"; Double Standard and 3" are furnished in two-layer construction. Sizes to fit straight runs of copper tubing with nominal diameters of ⅜" to 6" also available. Temperature limit 600 F.

**Pre-Shrunk Asbestocel Pipe Insulation:** Made of alternate layers of plain and corrugated asbestos felts. Furnished in 3-ft sections to fit standard steam and hot water piping, in following thicknesses: Coarse Corrugated, 2 to 8, ¼" plies and Fine Corrugated, 4 to 12, ⅙" plies. Finishes include a glazed white finish, asbestos-covered highspeed finish, and a regular canvas-covered finish. Temperature limit 300 F.

**Pre-Shrunk Wool Felt:** Made with a dual-service liner suitable for hot or cold water service lines. Composed of wool felt, indented by a special process and furnished in sections 3-ft long, in thicknesses of ½", ¾", 1", 1½" and 2", single layer; 1", 1½", 2" and 2½", double layer, for pipe sizes from ½" and up. Also furnished for straight runs of copper tubing, ⅜" and up. Available with a canvas or integral asbestos jacket finish. Temperature range 45 to 225 F, depending upon type of finish.

**Rock Cork Pipe Insulation and Lagging:** An efficient cold storage and refrigerated equipment material

made of mineral wool and a moisture-resistant binder. Pipe insulation is furnished for standard pipe sizes in 3-ft sections with integral waterproof jackets. Supplied in Ice Water, Brine and Heavy Brine thicknesses. Fittings are insulated with Zerotex. Lagging is furnished 18" or 36" long, 1½", 2", 3" and 4" thick and from 2" to 6" wide depending upon cylinder diameter. Also supplied to fit straight runs of copper tubing on special order. Temperature range — 400 F to + 150 F.

**Superex Pipe Insulation:** A combination of diatomaceous silica bonded with asbestos fiber. Furnished for standard pipe sizes in 3-ft sections or segments, up to 2½" thick single-layer; over 2½", two layers. Temperature limit 1900 F.

**Thermobestos Pipe Insulation:** Made of hydrous calcium silicate combined with asbestos fiber. Furnished for standard pipe sizes in 3-ft lengths up to 4" thick single layer; thicknesses of 2" and up can be furnished in double layer. Also, sizes available in sectional form up to 30" outside insulation diameter. Temperature limit 1200 F.

**Thermo-Wrap and Thermo-Tape:** Made of asbestos fibers enclosed in an asbestos cloth jacket. Outer surface is impregnated with fire- and abrasion-resisting coating. For insulating steam and hot water pipes on railroad and similar equipment . . . Thermo-Wrap is wrapped and laced on; Thermo-Tape is spirally wound on. Thermo-Wrap furnished in 3-ft sections; 1", 1½" and 2" thick for ¾" to 3" pipe; tubing, ⅞" to 3" OD; also tees, 45 and 90-deg ells, and crosses. Thermo-Tape supplied in 50-ft rolls; 2⅜" x ⅜", 2" x ¼", 1½" x ⅜", and 1" x ⅜". Temperature limit 450 F.

**Zerolite Pipe Insulation and Lagging:** An efficient cold storage and refrigerated equipment material made of mineral wool and a resin binder. Pipe insulation is furnished for standard pipe sizes in 3-ft sections with integral waterproof jackets. Supplied in Ice Water, Brine and Heavy Brine thicknesses. Fittings are insulated with Zerotex. Lagging is furnished 18" or 36" long, 1½", 2", 3" and 4" thick and from 2" to 6" wide depending upon cylinder diameter. Temperature range — 400 to + 250 F.

**Zero Pipe Insulation:** Composed of layers of hair felt and wool felt with a layer of saturated wool felt inside. Used to prevent water pipes from freezing under ordinary conditions. Should be protected with a jacket of Double-Coated Flexstone on outdoor installation. Furnished in 3-ft sections, 1¼" thick only, for standard pipe sizes and straight runs of copper tubing.

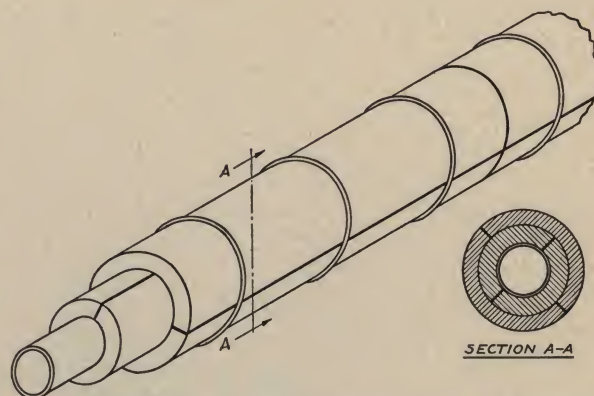


# Simplified Thicknesses for Pipe Insulation

Johns-Manville molded pipe insulations—85% Magnesia, Superex, and Thermobestos—are manufactured in accordance with Simplified Thicknesses. The purpose of Simplified Thicknesses is to permit the use of double-layer construction in all pipe sizes and thicknesses since the outside diameter of the pipe insulation is approximately the same as that of standard steel pipe.

The following table gives the actual wall thickness of pipe insulation for each nominal thickness. It also gives the corresponding pipe size of the outer layer for double-layer construction. In specifying, ordering or otherwise referring to these materials, only *nominal* thicknesses should be used. Actual wall thicknesses are given only for use in determining heat transmission or for other engineering calculations. The 1" nominal thickness is available in pipe sizes up to and including 6". For pipe sizes of 7" and larger, the minimum thickness furnished is nominal 1½". For pipe sizes and thicknesses available, refer to the data sheets on 85% Magnesia, Superex and Thermobestos.

At temperatures above 600 F, pipe expansion is a significant factor. For this reason, pipe insulation



*Simplified Thicknesses permit Double-Layer Construction with staggered joints for all temperatures above 600 F*

should be applied in double-layer construction with staggered joints for all temperatures above 600 F. This construction prevents excessive heat losses and surface temperatures at the joints, opened by pipe expansion, thus eliminating scorched or burned jackets. The construction also eliminates the potential fire hazard of exposing jackets to higher temperatures at the joints.

**Table of Simplified Thicknesses for Pipe Insulation**

Nominal Pipe Size, Inches	Nominal Thickness, inches																	
	1		1½		2		2½		3		3½		4		4½		5	
	Actual Thickness and Outer Layer Pipe Size, inches																	
	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size
½	1	2½	1⅞	3½	2⅞	4½	2⅞	6	3⅞	7	3⅞	8	4⅞	4⅞	5⅞	5⅞	5⅞	
¾	2⅞	2½	1⅞	3½	2⅞	4½	2⅞	6	3⅞	7	3⅞	8	4⅞	4⅞	5⅞	5⅞	5⅞	
1	3⅞	3	1⅞	4	2⅞	5	2⅞	6	3⅞	7	3⅞	8	4⅞	4⅞	5⅞	5⅞	5⅞	
1¼	4⅞	3	1⅞	4½	2⅞	5½	2⅞	6	3⅞	7	3⅞	8	4⅞	4⅞	5⅞	5⅞	5⅞	
1½	5⅞	3½	1⅞	4½	2⅞	5½	2⅞	6	3⅞	7	3⅞	8	4⅞	4⅞	5⅞	5⅞	5⅞	
2	6⅞	4	1⅞	5	2⅞	6	2⅞	7	3⅞	8	3⅞	9	4⅞	4⅞	5⅞	5⅞	5⅞	
2½	7⅞	4½	1⅞	6	2⅞	6½	2⅞	8	3⅞	9	3⅞	10	4⅞	4⅞	5⅞	5⅞	5⅞	
3	8⅞	5	1⅞	6	2⅞	7	2⅞	8	3⅞	9	3⅞	10	4⅞	4⅞	5⅞	5⅞	5⅞	
3½	9⅞	6	1⅞	7	2⅞	8	2⅞	9	3⅞	10	3⅞	11	4⅞	4⅞	5⅞	5⅞	5⅞	
4	10⅞	6	1⅞	7	2⅞	8	2⅞	9	3⅞	10	3⅞	11	4⅞	4⅞	5⅞	5⅞	5⅞	
4½	11⅞	7	1⅞	8	2⅞	9	2⅞	10	3⅞	11	3⅞	12	4⅞	4⅞	5⅞	5⅞	5⅞	
5	12⅞	7	1⅞	8	2⅞	9	2⅞	10	3⅞	11	3⅞	12	4⅞	4⅞	5⅞	5⅞	5⅞	
6	13⅞	8	1⅞	9	2⅞	10	2⅞	11	3⅞	12	3⅞	13	4⅞	4⅞	5⅞	5⅞	5⅞	
7	14⅞	—	1⅞	10	2⅞	11	2⅞	12	3⅞	13	3⅞	14	4⅞	4⅞	5⅞	5⅞	5⅞	
8	15⅞	—	1⅞	11	2⅞	12	2⅞	13	3⅞	14	3⅞	15	4⅞	4⅞	5⅞	5⅞	5⅞	
9	16⅞	—	1⅞	12	2⅞	13	2⅞	14	3⅞	15	3⅞	16	4⅞	4⅞	5⅞	5⅞	5⅞	
10	17⅞	—	1⅞	13	2⅞	14	2⅞	15	3⅞	16	3⅞	17	4⅞	4⅞	5⅞	5⅞	5⅞	
11	18⅞	—	1⅞	14	2⅞	15	2⅞	16	3⅞	17	3⅞	18	4⅞	4⅞	5⅞	5⅞	5⅞	
12	19⅞	—	1⅞	15	2⅞	16	2⅞	17	3⅞	18	3⅞	19	4⅞	4⅞	5⅞	5⅞	5⅞	
14	21⅞	—	1⅞	16	2⅞	17	2⅞	18	3⅞	19	3⅞	20	4⅞	4⅞	5⅞	5⅞	5⅞	
16	23⅞	—	1⅞	17	2	18	2⅞	19	3	20	3⅞	21	4	4⅞	5	5	5	
18	25⅞	—	1⅞	19	2	20	2⅞	21	3	22	3⅞	23	4	4⅞	5	5	5	
			1½	21	2	22	2⅞	23	3	24	3⅞	25	4	4⅞	5	5	5	







# Asbesto-Sponge Felted Pipe Insulation

*For temperatures to 700 F*

Asbesto-Sponge\* Felted Pipe Insulation is a most efficient commercial heat insulation for pipes conveying steam or fluids with temperatures up to 700 F.

It is especially designed to withstand, permanently and without disintegration, the high temperatures, as well as vibration and wear and tear, encountered in modern engineering practice.

The insulation is made of felts composed of asbestos fiber so combined to give a spongy laminated material. It is built up to the required thickness in laminations of approximately forty per inch of thickness, cemented together at intervals. For pipe insulation, these felts are wound one over the other until the desired thickness is obtained, the cylinder then being slit lengthwise to permit application.

The principal advantage of Asbesto-Sponge Felted Pipe Insulation over other types lies in its excellent thermal characteristics and in the permanency with which it retains these characteristics in service. Soaking this insulating material in water and then drying it out again has practically no effect upon its structure or insulating value.

Its high insulating value is due to its construction, which contains many surface resistances greatly reducing the transfer of heat through the material.

Asbesto-Sponge Felted, being a fabricated insulation, has a higher cost than some other types of insulating material. However, the cost of pipe insulation for any job is but a small part of the installed first cost. Thus for installations where the pipe insulation must withstand rough service or mechanical abuse and still maintain its high insulating value, the increased service life provided by Asbesto-Sponge Felted very often indicates it to have the lowest cost per year.

The felted nature of Asbesto-Sponge Felted makes it flexible to a considerable extent, and the insulation before and after application will stand much abuse without becoming damaged. So constructed as to eliminate breakage in shipment, handling and after applying, it can be removed and replaced many times.

Asbesto-Sponge Felted Pipe Insulation is furnished in 3-foot sections, in single-layer thicknesses (unless otherwise specified) from 1" to 2½", to accurately fit any commercial size pipe. Thicknesses greater than



2½" are normally furnished in double-layer construction. The insulation is finished with a canvas jacket and furnished with lacquered metal bands for holding in place.

Being slit on but one side only, for pipe sizes 4" and larger, the heat leakage through joints is reduced to a minimum, and application is facilitated.

Asbesto-Sponge Felted can also be supplied in sections to fit straight runs of copper pipe or tubing of outside diameters from ⅜" to 6".

Asbesto-Sponge Felted is also furnished in sheet or block form in a number of convenient sizes as described in another data sheet.

## Weatherproof Asbestos Jacket

Asbesto-Sponge Felted Pipe Insulation can be furnished with an integral weatherproof asbestos jacket attached to the factory.† This jacket is supplied with a 4" side-lap and with strips of felt, 7" wide, for a double circumferential wrap at the ends. The jacket is slit so that the pipe insulation can be applied in the regular manner. On horizontal pipe, the lap is turned downward to shed water. On vertical pipe, the lap should be sealed with Laptite (a J-M asphaltic cement). The side-laps of circumferential strips are made on the

\* Reg. U. S. Pat. Off.

† Called "Train Pipe Covering" in railroad work.



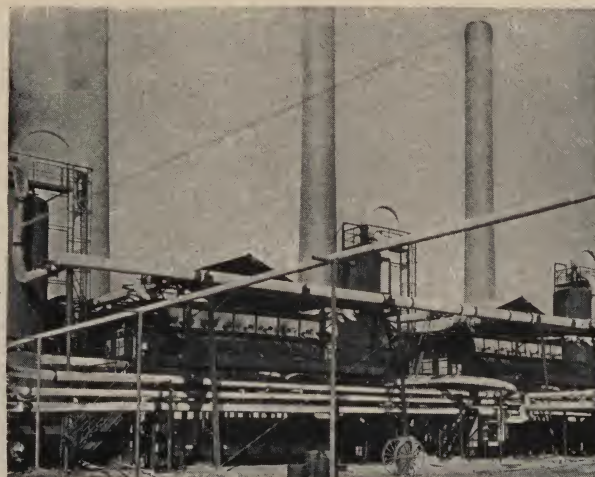
opposite side from the jacket lap and are turned downward on horizontal piping to shed water. On vertical piping, the circumferential strip should be sealed to the upper section with Laptite. No. 16 AWG Copperweld or galvanized wire loops are applied over the jacket on not more than 4" centers. Two loops of the same wire secure each circumferential strip. The wire, together with hot-dipped galvanized staples and Laptite, is furnished with the insulation.

### Permeable Asbestos Jacket\*\*

For use where subjected to water submersion, Asbesto-Sponge Felted can be furnished with a permeable jacket of wire-inserted asbestos cloth. This permits the escape of steam from the pipe insulation without disruption of the finish.

The jacket, which is attached to the pipe insulation, is provided with a 4" circumferential lap at one end, and two 4" laps over the longitudinal joint. When the insulation is applied, the longitudinal laps are held together, folded double and sewn to the jacket, as is

\*\* U. S. Patent No. 2,023,985.



*Asbesto-Sponge Felted Pipe Insulation withstands severe weathering on outdoor lines as well as the vibration and shock of mechanical impact*

the end lap. Copper wire or wire-inserted asbestos cord is used for stitching, together with hot-dipped galvanized staples and No. 16 AWG copperweld or galvanized wire for holding the insulation on 4" centers.

### Recommended Thicknesses in inches\*

Nominal pipe size, inches	Temperature of pipe—F					
	100 to 199	200 to 299	300 to 399	400 to 499	500 to 599	600 to 699
1½ & under	1	1	1	1½	1½	2
2	1	1	1½	1½	2	2
2½	1	1	1½	2	2	2
3	1	1	1½	2	2	2½
3½	1	1½	1½	2	2	2½
4	1	1½	1½	2	2½	2½
4½	1	1½	2	2	2½	2½
5	1	1½	2	2	2½	3
6	1	1½	2	2½	2½	3
7	1	1½	2	2½	2½	3
8	1	1½	2	2½	3	3
9	1	1½	2	2½	3	3½
10	1	2	2½	2½	3	3½
11	1	2	2½	3	3	3½
12	1	2	2½	3	3	3½
14 & over	1½	2	2½	3	3½	3½

\* Recommended thicknesses are optimum thicknesses calculated on an *economic* basis for heat conservation under average operating conditions and assure adequate temperature control. Unusual conditions may warrant the use of other thicknesses.

### Approximate Weight in Pounds, per Standard 3-foot Section, Unpacked

Insulation thickness, inches	Nominal Pipe Size, Inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
1	3.81	4.25	4.79	5.51	5.98	6.96	7.72	9.29	10.3	11.4	12.4	13.6	15.8	17.8	19.9	22.0	24.3	28.4
1½	7.24	7.91	8.73	9.80	10.6	12.0	13.3	15.5	17.0	18.6	20.2	21.9	25.2	28.3	31.4	34.5	37.9	44.2
2	11.8	12.6	13.7	15.1	16.1	18.1	19.8	22.7	24.8	26.9	28.9	31.2	35.7	39.8	43.9	48.0	52.7	60.9
2½	17.3	18.3	19.7	21.5	22.7	25.2	27.5	31.0	33.6	36.1	38.7	41.6	47.1	52.3	57.5	62.6	68.4	78.8
3	23.8	25.1	26.7	28.9	30.4	33.3	36.1	40.3	43.4	46.5	49.6	53.1	59.6	65.9	72.0	78.3	85.2	97.6



# Asbesto-Sponge Felted Pipe Insulation Heat Losses

Expressed in Btu per linear foot per hour

Insulation thickness, inches	Temperature of pipe—F											Temperature of pipe—F											
	100	150	200	250	300	350	400	450	500	550	600	100	150	200	250	300	350	400	450	500	550	600	
	Temperature difference between pipe and air—F											Temperature difference between pipe and air—F											
	25	75	125	175	225	275	325	375	425	475	525	25	75	125	175	225	275	325	375	425	475	525	
Nominal pipe size ½"												Nominal pipe size 3"											
1	3.51	11.0	19.1	27.7	37.0	46.8	57.5	68.9	80.9	93.3	107	8.93	28.0	48.8	71.1	95.3	121	148	178	209	242	278	
1½	2.99	9.35	16.2	23.6	31.5	39.8	48.7	58.1	68.0	78.3	89.8	7.07	22.1	38.3	55.7	74.3	94.6	116	138	162	187	214	
2	2.69	8.37	14.6	21.1	28.0	35.6	43.3	51.8	60.3	69.8	79.2	5.99	18.7	32.4	47.1	62.8	79.4	97.1	116	135	157	178	
2½	2.45	7.69	13.4	19.3	25.8	32.8	39.8	47.6	55.9	63.9	73.1	5.29	16.4	28.4	41.3	55.1	69.8	85.4	102	119	138	157	
3	2.33	7.26	12.5	18.2	24.2	30.5	37.3	44.3	51.8	59.6	67.7	4.73	14.7	25.5	37.0	49.8	63.0	76.8	91.5	107	123	141	
Nominal pipe size ¾"												Nominal pipe size 3½"											
1	3.97	12.5	21.6	31.5	42.1	53.4	65.4	78.2	91.7	106	121	9.93	31.1	54.2	78.9	106	134	165	198	232	269	308	
1½	3.37	10.5	18.2	26.4	35.3	44.6	54.5	65.2	76.2	88.2	100	7.79	24.3	42.1	61.2	82.0	104	127	152	178	206	236	
2	2.98	9.33	16.0	23.4	31.3	39.6	48.1	57.5	67.5	77.9	88.2	6.54	20.4	35.3	51.7	68.8	87.0	106	127	149	172	196	
2½	2.73	8.44	14.7	21.4	28.5	35.7	43.8	52.3	61.3	70.7	80.7	5.71	17.8	30.9	44.9	59.9	75.8	92.6	110	129	150	171	
3	2.54	7.89	13.6	20.0	26.6	33.5	40.8	48.5	57.3	65.8	74.6	5.17	16.1	27.8	40.3	54.2	68.4	83.4	99.1	117	134	153	
Nominal pipe size 1"												Nominal pipe size 4"											
1	4.53	14.2	24.7	36.0	48.0	60.8	74.7	89.4	105	121	139	10.9	34.2	59.5	86.9	116	148	182	218	256	297	339	
1½	3.78	11.8	20.5	29.8	39.6	50.3	61.6	73.6	85.8	99.2	113	8.49	26.5	46.1	67.0	89.7	113	139	166	194	225	257	
2	3.34	10.4	18.1	26.3	34.7	44.0	53.7	64.1	75.0	87.1	99.2	7.12	22.2	38.4	56.1	74.6	94.2	116	138	162	186	213	
2½	3.01	9.41	16.3	23.7	31.6	40.0	48.8	58.2	68.1	78.4	89.3	6.22	19.4	33.6	48.7	64.9	82.1	100	120	141	162	184	
3	2.82	8.75	15.1	22.1	29.3	36.8	45.4	53.8	62.6	72.7	82.3	5.57	17.3	29.9	43.8	58.1	73.3	90.2	107	125	145	164	
Nominal pipe size 1¼"												Nominal pipe size 4½"											
1	5.25	16.5	28.7	41.8	55.9	71.9	87.0	104	122	141	162	11.9	37.2	64.8	94.6	127	161	198	238	280	324	370	
1½	4.33	13.6	23.5	34.2	45.6	57.8	70.6	84.3	98.6	114	130	9.22	28.7	50.0	72.6	97.1	123	151	181	212	245	279	
2	3.78	11.8	20.4	29.6	39.7	50.2	61.2	72.9	85.7	98.6	112	7.72	24.0	41.5	60.6	80.6	102	125	149	174	201	230	
2½	3.40	10.6	18.3	26.9	35.7	45.1	55.0	65.4	77.1	88.7	101	6.68	20.8	36.3	52.7	70.1	88.6	108	130	151	174	199	
3	3.16	9.78	17.1	24.6	33.0	41.4	50.9	60.2	70.8	81.0	92.7	5.98	18.6	32.4	46.9	62.2	79.2	96.4	114	135	155	177	
Nominal pipe size 1½"												Nominal pipe size 5"											
1	5.75	18.0	31.3	45.6	61.0	77.6	95.0	114	134	155	177	13.0	40.7	70.8	103	138	176	216	259	305	354	404	
1½	4.69	14.7	25.5	37.1	49.4	62.9	76.8	91.5	107	124	141	10.0	31.3	54.3	79.2	105	134	164	196	230	266	304	
2	4.10	12.8	22.0	32.2	42.8	54.0	66.3	78.9	92.7	107	122	8.32	26.1	45.1	65.7	87.3	111	135	161	189	218	251	
2½	3.66	11.4	19.7	28.8	38.3	48.2	59.4	70.5	82.3	95.4	108	7.19	22.6	39.1	56.6	75.3	95.8	117	139	163	188	215	
3	3.36	10.6	18.1	26.5	34.9	44.4	54.5	64.5	75.7	87.5	98.9	6.43	20.0	34.8	50.3	67.4	84.9	104	124	145	167	191	
Nominal pipe size 2"												Nominal pipe size 6"											
1	6.70	21.1	36.5	53.3	71.4	90.7	111	133	157	181	208	15.1	47.2	82.1	120	161	204	251	301	354	411	471	
1½	5.42	16.9	29.4	42.6	57.0	72.0	88.3	106	124	143	163	11.5	36.1	62.4	90.8	121	154	188	226	264	306	349	
2	4.67	14.5	25.3	36.5	48.8	61.5	75.4	90.2	105	121	138	9.53	29.6	51.5	75.0	100	126	155	185	216	250	285	
2½	4.15	12.9	22.4	32.4	43.4	54.7	67.1	79.6	93.5	108	123	8.22	25.6	44.1	64.4	85.6	109	133	159	185	214	244	
3	3.78	11.8	20.6	29.5	39.5	50.0	61.3	72.4	84.8	97.9	112	7.27	22.8	39.2	57.3	75.9	96.3	118	140	164	190	215	
Nominal pipe size 2½"												Nominal pipe size 7"											
1	7.69	24.1	42.0	61.2	82.1	104	128	148	180	209	239	17.0	53.3	92.6	135	181	231	284	341	400	464	532	
1½	6.15	19.3	33.3	48.5	64.7	82.1	100	120	141	162	186	12.9	40.5	70.2	102	136	173	212	253	298	343	393	
2	5.22	16.3	28.4	41.3	55.1	69.3	84.8	101	119	137	158	10.6	33.1	57.5	83.6	112	141	173	207	242	279	318	
2½	4.64	14.5	25.0	36.5	48.7	61.3	75.1	89.7	105	120	138	9.09	28.5	49.2	71.7	95.2	121	147	176	207	237	271	
3	4.24	13.2	22.7	32.9	43.9	55.6	68.0	81.0	94.8	109	124	8.03	25.1	43.7	63.0	84.3	107	131	155	182	210	240	

(continued)



**Asbesto-Sponge Felted Pipe Insulation Heat Losses (Continued)**

Expressed in Btu per linear foot per hour

Insulation thickness, inches	Temperature of pipe—F											Temperature of pipe—F											
	100	150	200	250	300	350	400	450	500	550	600	100	150	200	250	300	350	400	450	500	550	600	
	Temperature difference between pipe and air—F											Temperature difference between pipe and air—F											
	25	75	125	175	225	275	325	375	425	475	525	25	75	125	175	225	275	325	375	425	475	525	
<i>Nominal pipe size 8"</i>												<i>Nominal pipe size 12"</i>											
1	18.9	59.2	103	151	202	257	316	380	447	518	593	26.8	84.3	147	214	288	365	449	540	635	737	845	
1½	14.3	44.7	77.6	113	151	192	235	281	330	382	436	20.1	63.1	109	159	212	270	331	396	464	536	614	
2	11.7	36.7	63.6	92.5	123	156	191	228	267	308	352	16.3	51.0	88.2	128	172	217	265	317	371	429	490	
2½	10.1	31.3	54.4	78.6	105	133	162	194	227	263	300	13.8	43.2	74.9	108	144	183	223	267	312	360	412	
3	8.80	27.6	47.9	69.7	92.2	117	143	171	200	231	263	12.0	37.6	65.0	94.5	126	159	195	232	271	315	358	
3½	7.97	24.8	42.9	62.3	82.8	106	129	153	179	206	236	10.7	33.7	58.2	84.1	113	142	173	207	242	280	318	
<i>Nominal pipe size 9"</i>												<i>Nominal pipe size 14"</i>											
1	20.8	65.3	114	166	223	283	348	418	491	569	653	29.3	92.0	160	234	314	398	490	589	692	803	925	
1½	15.7	49.1	85.1	124	167	211	258	309	362	419	479	21.9	68.4	119	173	231	293	360	430	505	583	668	
2	12.8	40.1	69.6	101	135	171	209	249	293	337	384	17.7	55.1	95.4	139	185	234	288	343	402	463	529	
2½	11.0	34.2	59.3	86.4	115	145	178	212	249	285	325	14.9	46.6	80.8	117	157	198	242	289	338	390	446	
3	9.61	30.0	52.1	75.8	100	127	155	186	217	251	285	13.0	40.8	70.7	103	137	173	211	251	294	338	387	
3½	8.70	27.1	46.8	72.1	90.1	115	140	166	194	225	256	11.5	36.3	62.5	91.3	121	154	188	225	262	303	343	
4												10.5	32.8	56.8	82.6	110	139	170	203	237	273	311	
<i>Nominal pipe size 10"</i>												<i>Nominal pipe size 16"</i>											
1	23.1	72.4	126	184	247	313	385	462	544	632	724	33.2	104	181	265	355	452	556	668	785	911	1044	
1½	17.3	54.3	94.1	137	183	232	285	340	400	462	528	24.6	76.9	134	194	260	330	404	483	569	657	750	
2	14.1	44.1	76.3	111	148	187	230	274	320	371	422	19.9	62.0	107	157	208	265	323	387	454	522	596	
2½	12.0	37.5	65.0	94.6	125	159	194	232	272	314	357	16.8	52.4	90.7	132	176	222	272	324	379	439	499	
3	10.5	32.9	57.1	82.2	110	139	170	202	237	273	311	14.5	45.3	78.5	114	152	193	236	281	328	380	432	
3½	9.42	29.3	50.6	74.1	98.4	124	153	181	211	245	278	12.9	40.2	70.0	101	136	171	209	248	292	338	383	
4												11.6	36.3	62.8	91.2	122	155	190	226	264	304	346	

Insulation thickness, inches	Temperature of pipe—F										
	100	150	200	250	300	350	400	450	500	550	600
	Temperature difference between pipe and air—F										
	25	75	125	175	225	275	325	375	425	475	525
<i>Nominal pipe size 18"</i>											
1	37.1	116	202	296	397	506	622	747	877	1018	1166
1½	27.4	85.9	149	217	290	368	451	541	634	732	838
2	22.0	69.2	120	174	232	295	360	436	505	580	663
2½	18.5	57.9	100	146	194	245	302	359	420	487	554
3	16.2	50.4	87.2	127	168	214	262	311	363	421	479
3½	14.2	44.7	77.0	112	149	189	230	275	323	370	423
4	12.8	40.3	69.8	101	135	170	208	248	292	336	383



# J-M 85% Magnesia Pipe Insulation

For temperatures to 600 F

J-M 85% Magnesia Pipe Insulation, suitable for temperatures to 600 F, combines the high insulating quality of hydrated basic carbonate of magnesia and asbestos, affording a light weight, efficient insulation.

Under actual service conditions, 85% Magnesia has proved to be a most durable molded insulation. The 85% Magnesia produced by the J-M process has a maximum number of voids or minute dead-air cells which increase its natural resistance to heat transmission and reduce its weight. This material affords maximum mechanical strength consistent with high insulating value.

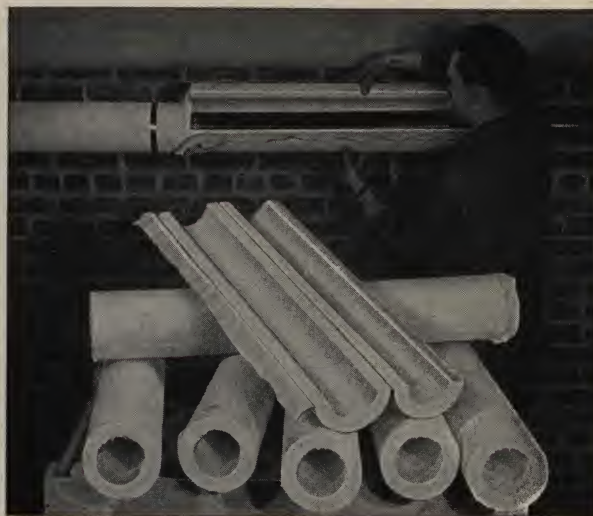
J-M 85% Magnesia Pipe Insulation is molded in accordance with Simplified Thicknesses in 3-ft lengths to fit standard pipe sizes. Nominal thicknesses of 1", 1½", 2" and 2½" can be furnished in a single layer. Nominal thicknesses of 2" (up to and including 4" pipe size) and 2½" (up to and including 6" pipe size) can also be furnished double-layer. The 1" nominal thickness is supplied up to and including 6" pipe size only. Nominal thicknesses of 3" and greater are normally furnished double-layer, although they can be furnished single-layer in limited quantities. Sizes to fit straight runs of copper tubing with nominal diameters of ⅜", ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 3½", 4", 5" and 6" are also available. The outside diameter of the tubing to be fitted must be stated in the order.

85% Magnesia Pipe Insulation is furnished in sectional form with canvas jackets, packed in suitable cartons. The insulation may be ordered without canvas jacket. Insulation for larger pipe sizes is furnished in segmental form, without canvas. Segments are supplied approximately 5" wide along the inner arc. Where necessary, an odd width segment may be supplied of the proper width to complete the circumference of the

## Properties\* of J-M 85% Magnesia Pipe Insulation

Density, lb per cu ft	13
Transverse Strength (Modulus of Rupture), psi	50
Linear Shrinkage (24-hr soaking period at 600 F), %	1.5
Conductivity, Btu in. per sq ft per F per hr at mean temperature,	
100 F	0.42
200 F	0.45
300 F	0.48
400 F	0.52

\* The figures given are average values obtained in accordance with accepted test methods.



Under actual service conditions, 85% Magnesia has proved to be a most durable and efficient molded insulation

particular pipe size. The form in which the various sizes of 85% Magnesia Pipe Insulation are furnished is shown on the reverse of this sheet.

## Recommended Thicknesses

The recommended thicknesses given below are optimum thicknesses calculated on an *economic* basis for heat conservation under average operating conditions and assure adequate temperature control. Unusual conditions may warrant the use of other thicknesses.

### Recommended Thicknesses of J-M 85% Magnesia Pipe Insulation

Nominal pipe size, inches	Temperature of pipe, F				
	100 to 199	200 to 299	300 to 399	400 to 499	500 to 599
	Nominal Thickness, inches				
1½ & under	1	1	1	1½	1½
2	1	1	1½	1½	2*
2½	1	1	1½	2*	2*
3	1	1	1½	2*	2*
3½	1	1½	1½	2*	2*
4	1	1½	1½	2*	2½*
4½	1	1½	2	2	2½*
5	1	1½	2	2	2½*
6	1	1½	2	2½*	2½*
7	1½	1½	2	2½	2½
8	1½	1½	2	2½	3**
9	1½	1½	2	2½	3**
10	1½	2	2½	2½	3**
11	1½	2	2½	3**	3**
12	1½	2	2½	3**	3**
14 & over	1½	2	2½	3**	3½**

\* Available in single or double-layer.

\*\* Normally furnished double-layer. Can be furnished single-layer in limited quantities.



*Approximate Weight of J-M 85% Magnesia Pipe Insulation per Standard 3-ft Section, pounds*

Insulation thickness, inches	Nominal Pipe Size, inches																		
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	11	12
1	1.59	1.51	2.21	1.98	2.57	3.04	3.54	3.95	5.93	5.02	7.25	5.98	6.47	—	—	—	—	—	—
1½	3.25	3.15	3.90	4.76	4.55	5.38	7.59	6.73	9.28	8.37	10.5	9.26	10.4	12.1	13.5	14.6	16.9	18.2	19.2
2	5.23	5.12	6.24	6.03	5.82	8.16	10.9	10.1	12.6	11.6	14.6	13.3	15.3	16.9	18.5	21.8	23.1	25.0	27.0
2½	9.26	9.18	9.02	8.81	12.0	11.5	14.3	13.3	16.4	15.6	19.2	18.2	20.0	22.1	25.7	28.1	29.6	32.5	34.6
3	12.4	12.3	12.2	11.9	15.3	14.8	18.2	17.2	21.3	20.5	24.2	22.9	25.2	29.4	32.0	34.6	37.2	39.8	42.4

*Form in which 85% Magnesia Pipe Insulation is furnished*

Nominal pipe size, inches	WAUKEGAN		MANVILLE			REDWOOD CITY	
	Nominal 1½", 2" and 2½" thick including inner layers of nominal 3" thick	Outer layers only of nominal 3" thick	Nominal 1½" and 2" thick, including inner layers of nominal 3" thick	Nominal 2½" thick	Outer layers only of nominal 3" thick	Nominal 1½", 2" and 2½" thick, including inner layers of nominal 3" thick	Outer layers only of nominal 3" thick
Under 8	sectional	sectional	sectional	sectional	sectional	sectional	sectional
8	sectional	sectional	sectional	sectional	sectional	sectional	sectional
9	sectional	segmental †	sectional	sectional	sectional	sectional	segmental
10	sectional	segmental †	sectional	sectional	segmental †	***	segmental
11	segmental †	segmental	segmental	segmental	segmental	segmental	segmental
12	segmental †	segmental	**	segmental	segmental	segmental	segmental
14	segmental*	segmental	segmental†	segmental	segmental	segmental	segmental
Over 14	segmental	segmental	segmental	segmental	segmental	segmental	segmental

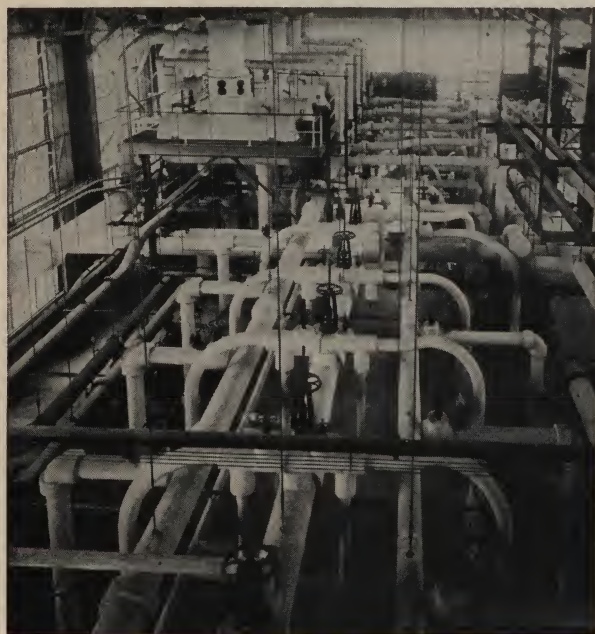
†—Can be furnished sectional, if so ordered.

\*—1½" and 2" thick can be furnished sectional, if so ordered.

\*\*—1½" thick furnished sectional; 2" thick can be furnished sectional, if so ordered.

†—1½" thick can be furnished sectional, if so ordered.

\*\*\*—1½" and 2" thick furnished sectional; 2½" thick furnished in two layers with sectional inner layer and segmental outer layer.

*(J-M 85% Magnesia is also furnished in the forms of blocks and lagging as described on another data sheet)**J-M 85% Magnesia affords maximum mechanical strength consistent with high insulating value*



# J-M 85% Magnesia Pipe Insulation

## Heat Transmission

Btu per linear foot per hour

Nom- inal thick- ness, inches	100	150	200	Temperature of Pipe—F								Nom- inal thick- ness, inches	100	150	200	Temperature of Pipe—F									
	25	75	125	Temperature difference between pipe and air—F									25	75	125	Temperature difference between pipe and air—F									
				175	225	275	325	375	425	475	525					175	225	275	325	375	425	475	525		
Nominal pipe size ½"													Nominal pipe size 3"												
1	3.92	11.9	20.4	29.2	38.1	47.5	57.2	67.2	77.4	87.7	98.9	1	9.87	30.3	51.5	73.7	96.7	121	145	171	198	225	253		
1½	3.24	9.93	16.7	24.1	31.4	39.0	47.1	55.3	63.8	72.6	82.0	1½	7.58	23.2	39.3	56.2	73.9	91.9	111	130	150	172	193		
2	2.89	8.82	15.1	21.4	28.1	34.8	41.9	49.4	56.8	64.9	73.0	2	6.40	19.6	33.3	47.2	62.2	77.1	92.7	109	125	142	162		
2½	2.51	7.67	13.1	18.7	24.5	30.6	36.7	43.1	49.6	57.1	63.9	2½	5.66	17.2	29.4	41.7	54.8	68.3	82.0	96.3	110	126	142		
3	2.35	7.17	12.4	17.8	23.1	28.9	34.6	40.4	46.4	54.1	60.6	3	5.09	15.6	26.4	37.8	49.1	61.5	74.2	86.7	101	115	130		
Nominal pipe size ¾"													Nominal pipe size 3½"												
1	4.65	14.2	24.2	34.5	45.3	56.5	68.1	79.8	92.1	105	118	1	9.57	29.4	50.0	71.3	93.2	119	140	165	190	217	245		
1½	3.73	11.4	19.3	27.6	36.1	45.0	53.9	63.4	73.1	83.3	93.9	1½	7.63	23.4	39.5	56.5	74.2	93.1	111	130	149	170	192		
2	3.26	9.99	17.0	24.2	31.7	39.6	47.3	56.0	64.5	73.5	82.5	2	6.64	20.5	34.3	49.1	64.4	80.0	96.1	113	130	148	166		
2½	2.82	8.65	14.6	21.1	27.5	34.3	41.1	48.5	55.9	63.7	71.5	2½	5.91	18.0	30.5	43.7	57.0	71.2	85.6	101	115	132	148		
3	2.62	7.99	13.6	20.0	25.8	32.0	38.3	44.9	52.1	59.5	66.4	3	5.24	16.0	27.2	39.0	50.4	63.1	76.5	90.0	104	120	135		
Nominal pipe size 1"													Nominal pipe size 4"												
1	4.82	14.8	24.9	35.3	47.2	58.6	70.3	82.4	94.8	110	123	1	11.8	36.2	61.7	88.1	115	144	173	205	236	269	301		
1½	4.03	12.3	20.9	29.9	39.3	48.8	58.7	69.0	79.7	90.8	102	1½	9.19	28.2	47.6	68.2	89.3	111	134	158	182	207	233		
2	3.54	10.8	18.4	26.2	34.3	42.7	51.4	60.3	69.4	79.1	88.8	2	7.65	23.5	39.8	56.5	74.2	92.5	112	132	151	172	193		
2½	3.19	9.76	16.5	23.7	31.0	38.4	46.3	54.3	62.7	71.3	80.1	2½	6.71	20.6	34.9	49.7	65.0	80.9	96.7	114	131	149	168		
3	2.94	8.93	15.1	21.9	28.6	35.4	42.6	50.3	58.1	65.9	74.1	3	5.93	18.2	30.2	43.8	57.6	71.9	85.8	101	118	133	150		
Nominal pipe size 1¼"													Nominal pipe size 4½"												
1	6.21	19.0	32.4	46.2	60.8	75.6	91.1	107	124	141	160	1	11.5	35.0	59.5	84.7	112	138	167	197	227	257	288		
1½	4.52	13.8	23.4	33.5	44.0	54.5	65.7	77.2	89.3	102	115	1½	9.00	27.5	46.7	66.7	87.4	108	131	154	178	202	227		
2	4.18	12.8	21.7	31.1	40.7	50.5	61.1	71.5	82.6	94.1	106	2	7.66	23.4	39.8	56.7	74.0	92.0	111	130	151	171	193		
2½	3.72	11.3	19.2	27.5	35.9	44.8	54.2	63.4	73.3	83.8	93.9	2½	6.78	20.8	35.2	50.5	66.0	81.7	98.5	115	134	151	172		
3	3.38	10.6	17.6	25.0	33.0	41.0	49.2	57.9	66.9	76.5	85.9	3	6.04	18.7	31.6	45.3	59.5	73.0	87.8	106	123	138	157		
Nominal pipe size 1½"													Nominal pipe size 5"												
1	6.35	19.8	33.3	47.4	61.8	77.2	92.3	107	126	145	163	1	14.4	44.3	74.9	107	141	174	211	249	288	330	371		
1½	5.10	15.7	26.5	37.9	49.8	62.0	74.4	87.6	101	116	130	1½	10.9	33.6	57.3	81.6	106	133	159	187	217	247	277		
2	4.13	12.7	21.5	30.6	40.0	50.2	60.0	70.5	81.6	92.8	104	2	8.99	27.5	46.8	66.9	87.6	108	130	153	177	201	227		
2½	3.72	11.3	19.5	27.5	35.9	45.1	54.0	63.7	73.4	83.7	94.2	2½	7.78	23.6	40.2	57.6	75.4	92.9	112	132	152	173	197		
3	3.42	10.4	18.1	25.4	32.9	41.4	49.7	58.8	67.4	76.9	86.7	3	6.90	21.0	35.8	51.2	67.1	83.0	100	118	137	155	175		
Nominal pipe size 2"													Nominal pipe size 6"												
1	7.29	22.4	38.0	54.2	71.2	88.6	107	126	145	166	186	1	16.8	52.3	88.3	127	167	206	248	292	339	385	435		
1½	5.80	17.8	30.3	43.0	56.2	70.3	84.3	99.2	114	130	147	1½	12.8	39.1	66.5	94.8	124	155	187	220	254	290	325		
2	4.93	15.0	25.5	36.5	47.9	59.6	71.9	84.1	96.8	110	125	2	10.3	31.6	53.7	76.7	100	125	151	177	204	232	260		
2½	4.42	13.3	22.8	32.6	42.8	53.2	64.4	74.9	86.7	98.7	111	2½	8.90	27.3	46.2	66.0	86.3	107	130	152	174	199	224		
3	4.02	12.3	21.0	29.7	39.1	48.4	58.7	68.5	79.4	91.0	102	3	7.87	24.0	40.7	58.1	76.1	94.8	115	135	155	177	199		
Nominal pipe size 2½"													Nominal pipe size 7"												
1	8.34	25.7	43.5	62.3	81.4	101	123	145	167	189	214	1½	14.2	43.2	73.6	105	138	172	207	244	282	320	359		
1½	5.94	18.2	30.9	44.1	57.6	71.9	86.4	102	117	133	151	2	12.7	35.1	59.8	85.5	112	140	168	198	229	259	291		
2	5.23	16.0	27.1	38.8	50.9	63.4	76.2	89.5	103	118	132	2½	10.5	30.0	51.2	73.0	96.0	119	144	169	196	221	250		
2½	4.68	14.3	24.3	34.7	45.5	56.4	68.1	80.1	92.2	106	119	3	9.42	25.9	44.4	63.2	82.9	103	125	147	169	191	217		
3	4.27	13.2	22.5	31.6	41.5	51.1	61.8	73.4	83.5	95.7	108	3½	8.41	23.2	40.3	57.3	75.1	93.7	112	132	152	172	195		



**J-M 85% Magnesia Pipe Insulation Heat Transmission (Continued)**

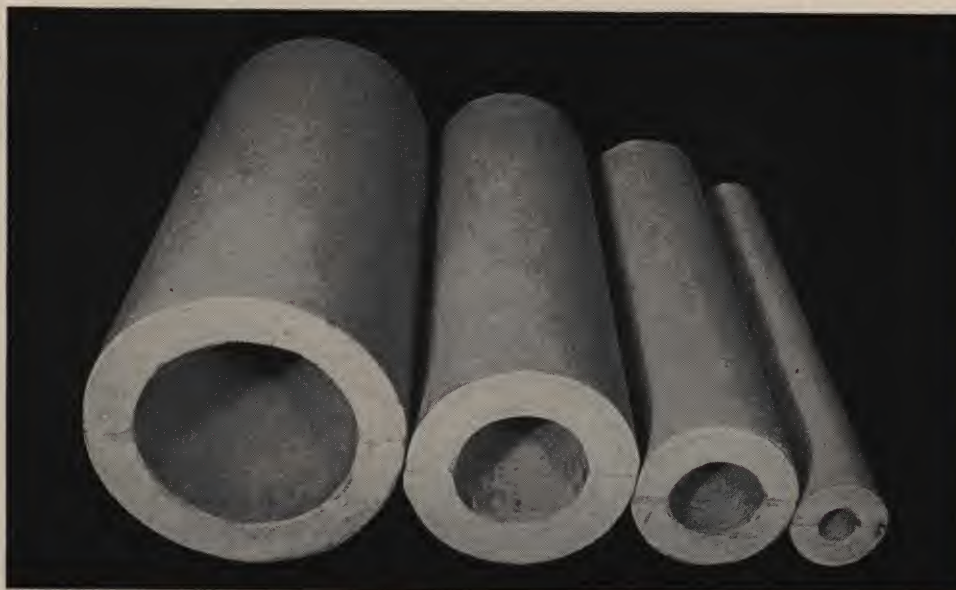
Btu per linear foot per hour

Nom- inal thick- ness, inches	Temperature of Pipe—F											Nom- inal thick- ness, inches	Temperature of Pipe—F										
	100	150	200	250	300	350	400	450	500	550	600		100	150	200	250	300	350	400	450	500	550	600
	Temperature difference between pipe and air—F												Temperature difference between pipe and air—F										
	25	75	125	175	225	275	325	375	425	475	525		25	75	125	175	225	275	325	375	425	475	525
<i>Nominal pipe size 8"</i>												<i>Nominal pipe size 12"</i>											
1½	15.7	47.8	81.3	116	153	190	229	270	311	355	400	1½	21.4	65.2	111	159	208	259	312	367	422	481	541
2	12.7	38.8	65.9	94.5	124	153	185	217	252	286	322	2	17.3	52.7	89.4	128	168	208	250	295	340	389	435
2½	10.5	31.8	54.3	77.4	102	126	152	178	206	234	263	2½	14.5	44.3	75.5	108	140	176	212	248	287	328	367
3	9.42	28.7	48.8	69.8	91.3	114	137	161	185	210	237	3	12.8	39.3	66.7	94.9	125	156	187	220	253	289	325
3½	8.41	25.9	43.9	63.0	81.6	103	123	144	166	190	212	3½	11.4	35.3	59.6	84.6	111	138	166	196	226	258	290
												4	10.3	31.5	53.8	76.2	100	124	151	177	204	232	262
<i>Nominal pipe size 9"</i>												<i>Nominal pipe size 14"</i>											
1½	17.2	52.7	89.6	128	167	211	252	297	343	389	439	1½	24.3	74.4	127	181	238	297	358	420	486	553	623
2	13.3	40.6	68.8	98.4	129	161	194	227	263	299	335	2	19.4	59.7	101	144	190	236	283	334	384	439	492
2½	11.5	35.0	59.8	85.0	111	139	167	196	226	258	288	2½	16.4	50.0	85.1	122	159	198	239	280	323	368	412
3	10.2	31.3	53.1	75.8	99.1	124	148	174	201	229	257	3	14.3	43.6	73.9	105	138	173	208	243	280	321	360
3½	9.01	27.9	46.8	66.9	88.0	111	132	156	180	205	232	3½	12.6	38.3	65.2	93.3	122	153	184	216	250	282	317
												4	11.4	35.0	59.0	84.6	110	138	165	194	225	254	287
<i>Nominal pipe size 10"</i>												<i>Nominal pipe size 16"</i>											
1½	18.5	56.4	95.1	137	179	223	270	317	365	417	469	1½	27.5	84.3	143	205	268	334	401	472	546	622	700
2	15.0	45.7	77.4	110	145	181	218	257	296	337	379	2	21.9	67.1	114	162	213	265	320	375	434	492	555
2½	12.8	38.9	66.4	94.2	124	155	185	218	252	286	321	2½	18.3	55.7	94.9	136	178	221	266	313	362	410	462
3	11.2	34.3	58.5	83.0	109	136	163	192	221	251	282	3	16.0	48.8	82.8	118	154	193	232	272	313	358	402
3½	9.98	30.9	51.7	74.4	97.5	123	148	173	199	225	255	3½	14.2	42.9	73.0	104	137	171	206	242	279	318	357
												4	12.7	38.6	66.0	93.4	123	152	184	217	248	283	320
<i>Nominal pipe size 18"</i>																							
1½	30.7	94.1	160	228	298	372	447	526	608	690	777	3	17.6	53.7	91.2	131	171	213	255	302	347	394	446
2	24.3	74.3	126	181	236	295	354	417	480	547	614	3½	15.6	47.7	81.1	116	150	187	226	265	306	348	392
2½	20.3	61.9	105	151	198	245	296	348	402	455	513	4	14.0	42.9	72.4	104	135	169	204	237	275	314	350



# Thermobestos Pipe Insulation

*For temperatures to 1200 F*



Thermobestos® Pipe Insulation is used for insulating steam and heated process lines which operate at temperatures up to 1200 F. The insulation, made by a special J-M process, is composed of hydrous calcium silicate combined with asbestos fiber.

At temperatures above 600 F, pipe expansion is a significant factor. For this reason, pipe insulation should be applied in double-layer construction with staggered joints for all temperatures above 600 F. This construction prevents excessive heat losses and surface temperatures at the joints, opened by pipe expansion, thus eliminating scorched or burned jackets. The construction also eliminates the potential fire hazard of exposing jackets to higher temperatures at the joints. Double-layer, staggered joint construction also minimizes thermal stresses in the insulation by reducing the temperature differential across each layer.

## Properties† of Thermobestos Pipe Insulation

Density, lb per cu ft.....	11
Transverse Strength (Modulus of Rupture), psi.....	60
Linear Shrinkage (24-hr soaking period at 1200 F), %...	1.5
Conductivity, Btu in. per sq ft per F per hr at mean temperature,	
100 F    200 F    300 F    400 F    500 F    600 F    700 F	
0.33    0.37    0.41    0.46    0.50    0.55    0.60	

† The figures given are average values obtained in accordance with accepted test methods.

## Sizes, Accessories and Packaging

Thermobestos Pipe Insulation is furnished in standard 3-ft lengths in accordance with Simplified Thicknesses.

Nominal thicknesses of 1", 1½", 2", 2½", 3", 3½" and 4" can be supplied in a single layer. Nominal thicknesses of 2" (up to and including 4" pipe size), 2½" (up to and including 6" pipe size), and greater thicknesses can also be furnished double-layer. The 1" nominal thickness is supplied in sectional form up to and including 6" pipe size. Other sizes for standard steel or iron pipes can be made in sectional form up to 30" outside insulation diameter, such as 22" pipe size x 4" thick, 24" pipe size x 3" thick, etc. Insulation for larger or non-standard pipe sizes can be supplied on special order.

Sectional pipe insulation up to and including 11" pipe size is regularly furnished with canvas jackets.

All sizes are packaged in cartons designed to meet standard handling and shipping requirements.

Thermobestos Pipe Insulation can be readily cut and applied by means of the regular tools and methods used by insulation applicators.

Thermobestos is also furnished in block form as described on another data sheet.



### Recommended Thicknesses

The figures given in the table of recommended thicknesses following are optimum thicknesses calculated on an *economic* basis for heat conservation under average

operating conditions and assure adequate temperature control. Unusual conditions may warrant the use of other thicknesses.

*Recommended Thicknesses of Thermobestos Pipe Insulation*

Nominal Pipe Size, Inches	Temperature of Pipe, F										
	100-199	200-299	300-399	400-499	500-599	600-699*	700-799*	800-899*	900-999*	1000-1099*	1100-1200*
Nominal Thickness, Inches											
1½ & under	1	1	1	1½	1½	2	2	2½	2½	2½	3
2	1	1	1½	1½	2**	2½	2½	2½	2½	3	3
2½	1	1	1½	2**	2**	2½	2½	3	3	3	3½
3	1	1	1½	2**	2**	2½	3	3	3	3½	3½
3½	1	1½	1½	2**	2**	2½	3	3	3½	3½	3½
4	1	1½	1½	2**	2½**	3	3	3	3½	3½	4
4½	1	1½	2	2	2½**	3	3	3½	3½	3½	4
5	1	1½	2	2	2½**	3	3	3½	3½	4	4
6	1	1½	2	2½**	2½**	3	3½	3½	4	4	4½
7	1½	1½	2	2½	2½	3½	3½	4	4	4	4½
8	1½	1½	2	2½	3**	3½	3½	4	4	4½	4½
9	1½	1½	2	2½	3**	3½	3½	4	4½	4½	5
10	1½	2	2½	2½	3**	3½	4	4	4½	4½	5
11	1½	2	2½	3**	3**	3½	4	4	4½	5	5
12	1½	2	2½	3**	3**	3½	4	4½	4½	5	5
14 & over	1½	2	2½	3**	3½**	3½	4	4½	4½	5	5½

\* At these temperatures, pipe insulation should be applied in double-layer construction with staggered joints for the reasons outlined on the reverse of this sheet.

\*\* Available in single or double-layer

*Approximate Weight of Thermobestos Pipe Insulation per Standard 3-ft Section, pounds*

Insulation thickness, inches	Nominal Pipe Size, inches																		
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	11	12
1	1.34	1.28	1.87	1.67	2.18	2.57	2.99	3.34	5.02	4.25	6.14	5.06	5.48	—	—	—	—	—	—
1½	2.75	2.66	3.30	4.03	3.85	4.55	6.42	5.70	7.85	7.08	8.91	7.83	8.78	10.3	11.4	12.3	14.3	15.4	16.3
2	4.42	4.33	5.28	5.10	4.93	6.91	9.26	8.54	10.6	9.86	12.3	11.2	13.0	14.3	15.6	18.5	19.6	21.1	22.9
2½	7.83	7.77	7.63	7.46	10.1	9.75	12.1	11.2	13.9	13.2	16.3	15.4	16.9	18.7	21.8	23.8	25.1	27.5	29.3
3	10.5	10.4	10.3	10.1	13.0	12.5	15.4	14.5	18.0	17.4	20.5	19.4	21.3	24.9	27.1	29.3	31.5	33.7	35.9



## Thermobestos Pipe Insulation Heat Transmission

**Btu per linear foot per hour**

Nominal thickness, inches	Temperature of pipe—F												Nominal thickness, inches	Temperature of pipe—F											
	100	200	300	400	500	600	700	800	900	1000	1100	1200		100	200	300	400	500	600	700	800	900	1000	1100	1200
	Temperature difference between pipe and air—F													Temperature difference between pipe and air—F											
	25	125	225	325	425	525	625	725	825	925	1025	1125		25	125	225	325	425	525	625	725	825	925	1025	1125
Nominal pipe size ½"																									
1	3.07	16.1	31.0	47.6	66.1	87.0	109	—	—	—	—	—	1	7.77	40.8	79.1	121	169	224	278	—	—	—	—	—
1½	2.54	13.4	25.4	38.8	53.9	70.1	88.3	107	130	—	—	—	1½	6.08	31.8	60.8	92.7	137	169	212	257	311	—	—	—
2	2.31	12.1	23.0	35.0	48.2	62.8	78.8	95.9	116	140	156	—	2	5.13	27.0	51.3	67.7	108	140	172	216	264	304	356	—
2½	2.04	10.5	20.2	30.7	42.3	55.5	69.3	84.5	101	119	138	157	2½	4.54	23.7	45.0	69.0	94.9	123	156	188	228	267	309	355
3	1.91	10.1	19.1	29.2	40.0	52.6	65.4	80.0	96.0	113	130	149	3	4.08	21.4	40.9	62.0	85.2	111	139	170	203	240	270	320
3½	1.82	9.54	18.1	27.7	37.9	49.5	61.9	75.6	90.7	107	123	141	3½	3.73	19.6	37.0	56.6	77.6	102	128	156	186	219	253	289
Nominal pipe size ¾"																									
1	3.64	19.1	36.8	56.6	78.0	104	130	—	—	—	—	—	1	7.54	39.5	75.9	117	161	213	266	—	—	—	—	—
1½	2.96	15.6	29.4	45.0	62.2	77.3	103	123	152	—	—	—	1½	6.09	32.1	60.7	92.8	128	168	212	253	317	—	—	—
2	2.64	13.7	26.1	40.0	55.0	71.4	90.0	109	133	154	179	—	2	5.27	27.6	52.7	80.0	100	145	182	221	271	309	—	—
2½	2.28	11.9	22.6	34.3	47.3	62.1	78.0	95.2	113	133	154	177	2½	4.71	24.8	46.9	71.6	98.4	128	161	195	236	278	318	368
3	2.15	11.2	21.2	32.0	44.1	57.9	72.6	88.4	106	125	144	165	3	4.22	22.0	43.9	63.5	87.5	115	142	176	209	248	285	327
3½	2.00	10.6	20.0	30.7	41.9	55.1	68.7	83.5	83.7	119	136	156	3½	3.88	20.4	38.8	58.7	77.7	106	133	163	194	228	263	303
Nominal pipe size 1"																									
1	3.80	19.9	38.2	59.0	81.5	108	135	—	—	—	—	—	1	3.67	19.1	36.0	55.2	75.3	99.5	124	152	181	214	246	283
1½	2.98	16.8	32.0	48.8	63.8	88.2	112	134	165	—	—	—	1½	3.27	17.6	34.5	54.4	74.3	98.4	123	151	180	213	246	283
2	2.84	14.8	28.2	43.1	59.5	77.1	96.9	118	142	166	194	—	2	3.07	16.1	32.9	52.8	72.7	96.8	121	149	177	210	243	280
2½	2.56	13.4	25.5	38.6	53.2	69.7	86.9	105	127	150	173	197	2½	2.87	14.7	31.5	51.4	71.3	95.4	120	148	176	209	242	279
3	2.37	12.5	23.5	35.9	49.5	64.8	81.2	99.1	118	139	161	185	3	2.70	13.7	30.5	50.4	70.3	94.4	119	147	175	208	241	278
3½	2.23	11.7	22.3	33.8	47.1	61.3	76.2	92.9	112	131	151	174	3½	2.55	13.4	25.5	38.8	52.9	69.6	87.2	106	127	149	172	198
Nominal pipe size 1¼"																									
1	4.86	25.7	49.5	75.8	106	140	175	—	—	—	—	—	1	8.95	46.9	90.2	139	192	253	319	—	—	—	—	—
1½	3.61	19.0	36.0	54.7	75.8	99.0	125	152	185	—	—	—	1½	7.18	37.9	71.8	110	151	198	251	300	377	—	—	—
2	3.34	17.5	33.4	50.8	70.3	89.3	115	139	171	198	229	—	2	6.10	32.3	61.2	93.0	129	168	211	257	310	360	—	—
2½	2.99	15.6	29.7	45.3	62.6	81.1	102	124	149	176	202	232	2½	5.42	28.4	54.0	82.3	114	148	186	226	273	317	370	426
3	2.75	14.3	27.3	41.4	56.9	74.7	93.8	114	136	161	185	213	3	4.89	25.5	48.3	74.0	102	132	166	203	242	286	327	376
3½	2.55	13.4	25.5	38.8	52.9	69.6	87.2	106	127	149	172	198	3½	4.45	23.3	43.5	67.4	92.7	122	153	186	222	262	302	345
Nominal pipe size 1½"																									
1	4.98	26.2	50.4	77.6	107	142	178	—	—	—	—	—	1	4.10	21.3	40.7	61.2	84.7	111	139	169	202	238	275	316
1½	4.10	21.6	40.8	62.3	85.2	112	142	185	209	—	—	—	1½	3.89	20.4	40.7	61.2	84.7	111	139	169	202	238	275	316
2	3.32	17.3	33.0	50.4	69.8	90.5	114	138	167	193	226	—	2	3.32	17.3	33.0	50.4	69.8	90.5	114	138	167	193	226	—
2½	3.00	15.7	31.2	45.1	62.3	81.5	101	125	149	176	203	233	2½	3.00	15.7	31.2	45.1	62.3	81.5	101	125	149	176	203	233
3	2.77	14.5	27.4	38.9	57.6	75.6	95.0	115	138	162	187	216	3	2.77	14.5	27.4	38.9	57.6	75.6	95.0	115	138	162	187	216
3½	2.59	13.6	25.9	39.5	53.8	70.9	88.5	108	129	152	175	202	3½	2.59	13.6	25.9	39.5	53.8	70.9	88.5	108	129	152	175	202
Nominal pipe size 2"																									
1	5.71	29.9	57.7	88.9	123	163	204	—	—	—	—	—	1	5.71	29.9	57.7	88.9	123	163	204	—	—	—	—	—
1½	4.60	24.3	46.0	70.0	95.7	125	160	208	236	—	—	—	1½	4.60	24.3	46.0	70.0	95.7	125	160	208	236	—	—	—
2	3.92	20.5	39.2	59.8	82.7	108	135	165	199	231	269	—	2	3.92	20.5	39.2	59.8	82.7	108	135	165	199	231	269	—
2½	3.77	19.6	37.0	56.9	78.6	102	120	133	176	206	244	276	2½	3.77	19.6	37.0	56.9	78.6	102	120	133	176	206	244	276
3	3.23	16.8	32.1	48.8	67.1	87.4	110	134	160	189	217	253	3	3.23	16.8	32.1	48.8	67.1	87.4	110	134	160	189	217	253
3½	2.97	15.7	29.7	44.9	62.2	81.4	102	124	149	175	202	232	3½	2.97	15.7	29.7	44.9	62.2	81.4	102	124	149	175	202	232
4	2.80	14.7	27.9	42.6	58.2	76.4	95.4	116	139	164	189	218	4	2.80	14.7	27.9	42.6	58.2	76.4	95.4	116	139	164	189	218
Nominal pipe size 2½"																									
1	6.55	34.4	66.5	102	142	188	233	—	—	—	—	—	1	6.55	34.4	66.5	102	142	188	233	—	—	—	—	—
1½	4.41	25.0	47.4	72.2	94.2	130	165	201	245	—	—	—	1½	4.41	25.0	47.4	72.2	94.2	130	165	201	245	—	—	—
2	4.20	22.0	42.0	64.0	88.1	117	142	165	212	246	285	—	2	4.20	22.0	42.0	64.0	88.1	117	142	165	212	246	285	—
2½	3.77	19.6	37.0	56.9	78.6	102	128	156	187	225	253	291	2½	3.77	19.6	37.0	56.9	78.6	102	128	156	187	225	253	291
3	3.45	18.1	34.3	52.1	71.6	94.0	118	144	171	202	232	270	3	3.45	18.1	34.3	52.1	71.6	94.0	118	144	171	202	232	270
3½	3.16	16.7	31.6	48.1	66.3	87.0	108	133	159	187	215	248	3½	3.16	16.7	31.6	48.1	66.3	87.0	108	133	159	187	215	248
4	3.00	15.7	29.9	45.6	62.7	82.3	103	125	150	177	203	233	4	3.00	15.7	29.9	45.6	62.7	82.3	103	125	150	177	203	233
Nominal pipe size 3"																									
1	13.3	70.0	135	209	289	384	—	—	—	—	—	—	1	13.3	70.0	135	209	289	384	—	—	—	—	—	—
1½	10.1	52.9	102	153	216	285	355	—	—	—	—	—	1½	10.1	52.9	102	153	216	285	355	—	—	—	—	—
2	8.19	43.1	81.9	125	167	226	285	344	422	—	—	—	2	8.19	43.1	81.9	125	167	226	285	344	422	—	—	—
2½	7.10	37.3	70.7	108	149	194	244	295	361	419	486	560	2½	7.10	37.3	70.7	108	149	194	244	295	361	419	486	560
3	6.31	32.9	62.4	95.6	132	172	215	262	316	372	425	492	3	6.31	32.9	62.4	95.6	132	172	215	262	316	372	425	492
3½	5.57	28.9	57.9	83.5	115	151	186	230	274	325	374	429	3½	5.57	28.9	57.9	83.5	115	151	186	230	274	325	374	429
4	5.17	26.9	51.3	77.5	107	140	176	215	256	302	349	401	4	5.17	26.9	51.3	77.5	107	140	176	215	256	302	349	401
4½	4.82	25.1	47.4	72.3	97.2	130	163	199	238	281	324	372	4½	4.82	25.1	47.4	72.3	97.2	130	163	199	238	281	324	372
5	4.44	23.4	44.4	67.6	92.9	122	152	186	222	262	302	347	5	4.44	23.4	44.4	67.6	92.9	122	152	186	222	262	302	347



## Thermobestos Pipe Insulation Heat Transmission (Continued)

Btu per linear foot per hour

Nominal thickness, inches	Temperature of pipe—F												Nominal thickness, inches	Temperature of pipe—F											
	100	200	300	400	500	600	700	800	900	1000	1100	1200		100	200	300	400	500	600	700	800	900	1000	1100	1200
	Temperature difference between pipe and air—F													Temperature difference between pipe and air—F											
	25	125	225	325	425	525	625	725	825	925	1025	1125		25	125	225	325	425	525	625	725	825	925	1025	1125
Nominal pipe size 7"													Nominal pipe size 12"												
1½	11.2	58.8	113	170	240	316	395	—	—	—	—	—	1½	16.9	88.5	170	256	358	480	597	—	—	—	—	—
2	9.18	48.0	91.8	140	193	253	318	386	468	—	—	—	2	13.7	72.3	137	210	278	378	479	580	—	—	—	—
2½	7.87	41.2	78.7	120	166	215	272	329	405	462	541	624	2½	11.6	75.9	116	177	245	318	401	485	599	688	801	—
3	6.83	35.8	67.9	104	143	186	234	284	344	403	461	534	3	10.3	53.5	102	156	216	281	354	429	512	607	706	806
3½	6.19	32.3	61.5	93.9	130	169	211	258	308	363	417	479	3½	9.24	48.0	90.8	139	192	250	313	383	460	538	616	720
4	5.69	29.8	56.5	85.6	118	155	194	237	282	332	384	441	4	8.36	43.4	86.9	125	173	226	279	346	412	488	561	643
4½	5.25	27.6	52.1	79.5	109	143	180	219	262	309	357	409	4½	7.66	40.0	76.0	115	159	208	262	320	380	448	518	593
5	4.91	25.8	48.7	74.4	102	135	168	205	245	289	332	383	5	7.11	36.6	70.5	107	148	194	242	295	353	416	481	550
5½	4.67	24.6	46.7	71.1	97.8	128	160	195	235	276	318	365	5½	6.70	34.8	67.0	94.6	138	182	227	277	331	390	450	517
													6	6.25	32.9	62.4	89.4	131	172	214	261	315	369	425	488
Nominal pipe size 8"													Nominal pipe size 14"												
1½	12.4	64.8	124	187	263	352	437	—	—	—	—	—	1½	19.2	101	216	298	413	543	680	—	—	—	—	—
2	10.2	53.8	101	155	213	281	355	425	521	—	—	—	2	15.5	81.0	155	236	329	429	542	650	—	—	—	—
2½	8.32	43.6	83.2	127	175	227	272	329	405	462	541	624	2½	13.0	68.6	130	197	273	357	450	547	666	771	905	—
3	7.59	39.7	75.5	115	159	206	259	315	381	444	517	596	3	11.4	61.7	114	174	239	311	391	475	581	649	774	900
3½	6.77	35.3	67.3	103	142	184	230	281	336	396	453	527	3½	10.1	52.8	100	153	212	275	345	421	507	593	676	786
4	6.13	32.0	61.0	92.1	123	168	210	256	304	360	414	476	4	9.15	47.8	90.9	139	192	249	312	381	455	536	616	708
4½	5.70	29.8	56.0	85.7	118	154	195	237	283	333	385	442	4½	8.37	43.9	83.0	126	174	228	283	349	415	491	565	650
5	5.32	27.8	53.2	80.5	110	145	180	220	264	311	358	413	5	7.72	40.6	77.2	117	161	212	265	324	385	454	524	603
5½	5.02	26.5	50.1	76.4	105	138	172	210	253	296	342	392	5½	7.26	37.9	72.0	109	150	198	247	301	359	424	487	562
													6	6.77	35.6	67.7	103	141	185	231	282	339	398	460	528
Nominal pipe size 9"													Nominal pipe size 16"												
1½	13.6	71.4	138	211	292	388	481	—	—	—	—	—	1½	21.6	113	244	335	463	612	766	—	—	—	—	—
2	10.7	55.8	107	162	223	293	368	445	554	—	—	—	2	17.4	91.1	174	218	366	482	612	733	—	—	—	—
2½	9.15	48.1	91.1	140	193	251	317	383	465	539	633	731	2½	14.6	77.5	146	222	308	401	507	615	753	863	1011	—
3	8.19	42.8	81.5	124	171	223	280	341	411	482	557	640	3	12.7	66.8	127	193	268	347	438	530	645	749	869	1002
3½	7.31	38.1	69.6	111	152	198	248	303	364	428	492	567	3½	11.3	59.9	113	172	237	308	386	470	567	668	764	885
4	6.71	34.9	66.2	101	139	182	229	278	332	391	451	521	4	10.2	53.3	101	154	213	276	346	423	507	597	678	798
4½	6.15	31.9	61.0	92.2	128	168	211	257	302	361	417	480	4½	9.36	48.7	92.3	141	194	253	319	388	461	546	628	727
5	5.79	30.1	56.9	87.1	119	157	196	239	286	338	388	448	5	8.64	45.0	85.8	129	179	234	294	359	428	504	581	668
5½	5.41	28.4	53.9	82.2	113	149	185	226	271	319	367	422	5½	7.99	41.9	79.9	122	167	218	274	338	398	469	539	621
													6	7.48	39.4	74.8	106	156	204	255	311	369	438	506	583
Nominal pipe size 10"													Nominal pipe size 18"												
1½	14.5	76.0	147	222	312	409	512	—	—	—	—	—	1½	24.2	127	244	374	517	682	858	—	—	—	—	—
2	11.9	63.0	119	182	251	329	415	497	611	—	—	—	2	19.3	101	193	296	408	530	680	813	—	—	—	—
2½	10.1	53.4	101	154	215	278	351	426	518	597	701	—	2½	16.2	85.5	162	246	342	446	562	680	831	957	1126	—
3	8.97	47.1	89.2	137	188	245	308	373	452	524	608	701	3	14.0	73.5	140	214	296	385	484	588	710	830	962	1113
3½	8.08	42.2	80.4	122	169	219	274	334	402	475	545	625	3½	12.5	65.4	124	185	261	340	425	519	626	733	844	975
4	7.35	38.3	73.0	111	152	200	249	302	365	429	495	566	4	11.3	58.6	107	170	235	304	382	466	559	659	756	872
4½	6.74	35.4	66.9	102	141	184	231	282	337	396	458	528	4½	10.3	53.7	101	155	214	279	352	428	509	602	692	799
5	6.26	33.0	62.6	94.9	131	171	215	262	314	369	426	489	5	9.39	49.4	93.9	142	197	258	324	395	470	552	639	734
5½	5.86	30.9	58.6	88.5	122	160	200	244	290	344	397	457	5½	8.81	45.9	87.4	132	182	239	300	365	437	515	593	682
													6	8.49	43.1	81.8	123	171	226	281	341	410	482	556	640



# Superex Pipe Insulation

*For temperatures to 1900 F*

Superex® is the most adaptable material for insulating surfaces where the material applied must resist temperatures between 600 and 1900 F.

In the manufacture of Superex, specially selected and calcined diatomaceous silica is blended with other insulating materials and bonded with asbestos fiber. This combination produces a material of high heat resistance and insulating value.

It has excellent thermal characteristics, which are maintained in service. It will safely withstand temperatures up to 1900 F and, although weighing only approximately 2 lb per sq ft per inch thickness, possesses adequate strength.

Superex Pipe Insulation is molded in 3-ft lengths in accordance with Simplified Thicknesses. Nominal thicknesses of 1", 1½", 2", 2½" and 3" are furnished to fit standard pipe sizes. The 1" nominal thickness is supplied up to and including 6" pipe size only. Smaller pipe sizes are furnished sectional. Larger pipe sizes are supplied sectional or segmental as shown in tabular form on the reverse of this sheet. Canvas jackets are regularly furnished with the insulation for pipe sizes 1½" and smaller.

Superex is also furnished in block form as described on another data sheet.

## Properties† of Superex Pipe Insulation

Density, lb per cu ft.....	24
Transverse Strength (Modulus of Rupture), psi.....	70
Linear Shrinkage (24-hr soaking period at 1900 F), %...	2.7
Conductivity, Btu in. per sq ft per F per hr at mean temperature,	
300 F    400 F    500 F    600 F    700 F    800 F    900 F	
0.67    0.69    0.71    0.73    0.75    0.77    0.79	

† The figures given are average values obtained in accordance with accepted test methods.

## Superex-85% Magnesia Combination

At all temperatures above 600 F, pipe expansion is a significant factor. For this reason, pipe insulation



*Superex Combination Pipe Insulation, consisting of an inner layer of Superex and an outer layer of 85% Magnesia*

should be applied in double-layer construction with staggered joints for all temperatures above 600 F. This construction prevents excessive heat losses and surface temperatures at the joints, opened by pipe expansion, thus eliminating scorched or burned jackets. The construction also eliminates the potential fire hazard of exposing jackets to higher temperatures at the joints. Thus the combination of an inner layer of Superex and an outer layer of J-M 85% Magnesia is ideal. In addition, this combination combines the high heat resistance of Superex with the greater insulating value of 85% Magnesia.

When ordering Superex-85% Magnesia Combination Pipe Insulation, the quantities, pipe sizes and thicknesses of both materials should be given.

## Recommended Thicknesses

The tables on the reverse of this sheet give recommended thicknesses.

These recommended thicknesses are optimum thicknesses calculated on an *economic* basis for heat conservation under average operating conditions and assure adequate temperature control. Unusual conditions may

## Approximate Weight of Superex Pipe Insulation per Standard 3-ft Section, pounds

Insulation thickness, inches	Nominal Pipe Size, inches																
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10
1	2.93	2.78	4.08	3.65	4.75	5.62	6.53	7.30	10.9	9.26	13.4	11.0	12.0	—	—	—	—
1½	6.00	5.81	7.20	8.78	8.40	9.94	14.0	12.4	17.1	15.5	19.4	17.1	19.2	22.4	25.0	26.9	31.2
2	9.65	9.46	11.5	11.1	10.8	15.1	20.2	18.6	23.2	21.5	26.9	24.5	28.3	31.2	34.1	40.3	42.7
2½	17.1	16.9	16.7	16.3	22.1	21.3	26.4	24.5	30.2	28.8	35.5	33.6	37.0	40.8	47.5	51.8	54.7
3	22.9	22.8	22.5	22.0	28.3	27.4	33.6	31.7	39.4	37.9	44.6	42.2	46.6	54.2	59.0	63.8	68.6



warrant the use of other thicknesses. When different check must be made of the temperature on the outer thicknesses are used than recommended in the table, a layer to determine that its safe limit is not exceeded.

**Recommended Thicknesses of Superex-85% Magnesia Combination Pipe Insulation  
(Superex Inner Layer and J-M 85% Magnesia Outer Layer)**

Nominal Pipe Size, Inches	Temperature of Pipe, F																							
	600 to 699				700 to 799				800 to 899				900 to 999				1000 to 1099				1100 to 1200			
	Nominal Thicknesses and Outer Layer Pipe Sizes, Inches																							
	Inner Layer	Pipe Size	Outer Layer	Total	Inner Layer	Pipe Size	Outer Layer	Total	Inner Layer	Pipe Size	Outer Layer	Total	Inner Layer	Pipe Size	Outer Layer	Total	Inner Layer	Pipe Size	Outer Layer	Total	Inner Layer	Pipe Size	Outer Layer	Total
1½ & less	2	—	none	2	2	—	none	2	2½	—	none	2½	2½	—	none	2½	2½	—	none	2½	3	—	none	3
2	1	4	1½	2½	1	4	1½	2½	1	4	1½	2½	1	4	1½	2½	1	4	1½	2½	3	6	1	3
2½	1	4½	1½	2½	1	4½	1½	2½	1½	6	1½	3	1½	6	1½	3	1½	6	1½	3	2	7	1½	3½
3	1	5	1½	2½	1	5	2	3	1½	6	1½	3	1½	6	1½	3	2	7	1½	3½	2	7	1½	3½
3½	1	6	1½	2½	1	6	2	3	1½	7	1½	3	2	8	1½	3½	2	8	1½	3½	2	8	1½	3½
4	1	6	2	3	1	6	2	3	1½	7	1½	3	2	8	1½	3½	2	8	1½	3½	2½	9	1½	4
4½	1	7	2	3	1	7	2	3	1½	8	2	3½	2	9	1½	3½	2	9	1½	3½	2	10	1½	4
5	1	7	2	3	1	7	2	3	1½	8	2	3½	2	9	1½	3½	2½	10	1½	4	2½	10	1½	4
6	1	8	2	3	1½	9	2	3½	1½	9	2	3½	2	10	2	4	2	11	2	4	2	12	1½	4½
7	1½	10	2	3½	1½	10	2	3½	2	11	2	4	2	11	2	4	2	12	1½	4	3	14	1½	4½
8	1½	11	2	3½	1½	11	2	3½	2	12	2	4	2	12	2	4	2	14	2	4½	3	15	1½	4½
9	1½	12	2	3½	1½	12	2	3½	2	14	2	4	2	14	2	4	2	15	2	4½	3	16	2	5
10	1½	14	2	3½	1½	14	2	3½	2	15	2	4	2	15	2	4	2	16	2	4½	3	17	2	5
11	1½	15	2	3½	1½	15	2	3½	2	16	2	4	2	16	2	4	3	18	2	5	3	18	2	5
12	1½	16	2	3½	1½	16	2	3½	2	18	2	4½	2	18	2	4½	3	19	2	5	3	19	2	5
14	1½	17	2	3½	1½	17	2	3½	2	19	2	4½	2	19	2	4½	3	20	2	5	3½	21	2	5½
15	1½	18	2	3½	1½	18	2	3½	2	20	2	4½	2	20	2	4½	3	21	2	5	3½	22	2	5½
16	1½	19	2	3½	1½	19	2	3½	2	21	2	4½	2	21	2	4½	3	22	2	5	3½	23	2	5½
17	1½	20	2	3½	1½	20	2	3½	2	22	2	4½	2	22	2	4½	3	23	2	5	3½	24	2	5½
18	1½	21	2	3½	1½	21	2	3½	2	23	2	4½	2	23	2	4½	3	24	2	5	3½	25	2	5½
19	1½	22	2	3½	1½	22	2	3½	2	24	2	4½	2	24	2	4½	3	25	2	5	3½	26	2	5½
20	1½	23	2	3½	1½	23	2	3½	2	25	2	4½	2	25	2	4½	3	26	2	5	3½	27	2	5½
21	1½	24	2	3½	1½	24	2	3½	2	26	2	4½	2	26	2	4½	3	27	2	5	3½	28	2	5½
22	1½	25	2	3½	1½	25	2	3½	2	27	2	4½	2	27	2	4½	3	28	2	5	3½	29	2	5½
23	1½	26	2	3½	1½	26	2	3½	2	28	2	4½	2	28	2	4½	3	29	2	5	3½	30	2	5½
24	1½	27	2	3½	1½	27	2	3½	2	29	2	4½	2	29	2	4½	3	30	2	5	3½	31	2	5½
26	1½	29	2	3½	1½	29	2	3½	2	31	2	4½	2	31	2	4½	3	32	2	5	3½	33	2	5½
27	1½	30	2	3½	1½	30	2	3½	2	32	2	4½	2	32	2	4½	3	33	2	5	3½	34	2	5½
28	1½	31	2	3½	1½	31	2	3½	2	33	2	4½	2	33	2	4½	3	34	2	5	3½	35	2	5½
30	1½	33	2	3½	1½	33	2	3½	2	35	2	4½	2	35	2	4½	3	36	2	5	3½	37	2	5½
32	1½	35	2	3½	1½	35	2	3½	2	37	2	4½	2	37	2	4½	3	38	2	5	3½	39	2	5½
33	1½	36	2	3½	1½	36	2	3½	2	38	2	4½	2	38	2	4½	3	39	2	5	3½	40	2	5½

**Number of Segments of Superex and 85% Magnesia Pipe Insulation**

Nominal Pipe Size, Inches	WAUKEGAN				MANVILLE								REDWOOD CITY			
	Nominal Thicknesses Given				Nominal Thicknesses Given								Nominal Thicknesses Given			
	1½" thick, including inner layers of 3" thick	2" thick	2½" thick	Outer layers only of 3" thick	1½" and 2" thick, including inner layers of 3" thick		2½" thick		Outer layers only of 3" thick		1½", 2", 2½" thick, including inner layers of 3" thick		Outer layers only of 3" thick			
	Equal	Odd	Equal	Odd	Equal	Odd	Equal	Odd	Equal	Odd	Equal	Odd	Equal	Odd	Equal	Odd
8	sect.	sect.	sect.	sect.	sect.	sect.	sect.	sect.	sect.	sect.	sect.	sect.	6	1		
9	sect.	sect.	sect.	8	sect.	sect.	sect.	sect.	sect.	sect.	sect.	sect.	7	none		
10	sect.	sect.	sect.	8	sect.	sect.	sect.	sect.	8	1	***	***	7	1		
11	8	8	8	9	7	1	7	1	8	1	6	1	7	1		
12	8	8	8	9	8	none	7	1	7	1	7	none	8	1		
14	8	9	9	10	8	1	8	1	8	1	7	1	9	1		
15	9	9	9	11	9	1	9	1	9	1	8	1	10	1		
16	9	10	10	11	9	1	9	1	9	1	9	none	10	1		
17	10	10	10	12	10	1	10	1	10	1	9	1	11	none		
18	11	11	11	12	11	1	11	none	11	none	10	1	11	1		
19	11	11	11	13	11	1	11	none	13	1	10	1	12	none		
20	12	12	12	13	12	1	12	1	12	1	11	none	12	1		
21	12	12	12	14	13	none	13	none	15	none	11	1	13	none		
22	13	13	13	14	13	1	13	1	15	1	12	none	13	1		
23	13	13	13	14	14	1	14	1	16	1	12	1	14	none		
24	14	14	14	14	15	none	14	1	14	1	13	none	14	1		
25**	14	14	14	—	15	1	15	1	—	—	13	1	—	—		
26	15	15	15	15	16	none	16	none	18	1	14	none	15	1		
27	15	15	15	16	17	1	17	1	19*	none	14	1	16	1		
28	16	16	16	16	18	none	17	1	19	1	15	1	16	1		
29**	16	16	16	—	18	1	18	1	—	—	15	1	—	—		
30	17	17	17	17	19*	none	18*	1*	18	1	16	1	18	1		
31**	17	17	17	—	16	1	16	1	—	—	16	1	—	—		
32	17	17	18	19	16	1	16	1	18	1	17	1	19	1		
33	18	18	18	19	17	1	17	1	18	1	18	1	20	1		

Sect.—Furnished in sectional form packed in cartons with metal bands.

†—Can be furnished sectional, if so ordered.

††—1½" thick furnished sectional; 2" thick can be furnished sectional, if so ordered.

†††—1½" thick can be furnished sectional, if so ordered.

\*—Can be furnished in wider segments (15 equal and 1 odd width), if so ordered.

\*\*—Outer layers only. Pipe not manufactured in this size.

\*\*\*—1½" and 2" thick furnished sectional; 2½" thick furnished in two layers with 1½" thick sectional inner layer and 1½" thick segmental outer layer (7 equal and 1 odd width segments).



# Superex Combination Insulation (with 85% Magnesia) Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.  
Efficiency expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of 85% Magnesite, inches	Thickness of 85% Magnesite, inches	Total thickness of insulation, inches	Temperature of pipe—deg. Fahr.				Thickness of Superex insulation, inches	Pipe size of 85% Magnesite, inches	Thickness of 85% Magnesite, inches	Total thickness of insulation, inches	Temperature of pipe—deg. Fahr.					
				500	600	700	800					500	600	700	800		
				Temperature difference, pipe to air—deg. Fahr.								Temperature difference, pipe to air—deg. Fahr.					
425	525	625	725	425	525	625	725	425	525	625	725	425	525	625	725		
Nominal pipe size 1/2"																	
1 1/2	No outer layer	1 1/2	Heat Loss, B.t.u.	.840	.856	.872	.888	1 1/2	8	2	3 1/2	Heat Loss, B.t.u.	.223	.229	.235	.241	
2	No outer layer	2	Efficiency %	80.23	83.37	85.42	87.38	2 1/2	4	Efficiency %	94.74	95.56	96.14	96.81	97.26	97.68	
			Heat Loss, B.t.u.	.755	.767	.779	.793					Heat Loss, B.t.u.	.205	.210	.215	.222	
			Efficiency %	82.23	85.09	87.20	88.73		3	4 1/2	Efficiency %	95.17	95.92	96.47	96.84	97.28	
												Heat Loss, B.t.u.	.190	.195	.200	.206	
												Efficiency %	95.52	96.22	96.72	97.07	
Nominal pipe size 3/4"																	
1 1/2	No outer layer	1 1/2	Heat Loss, B.t.u.	.752	.767	.782	.797	1 1/2	9	2	3 1/2	Heat Loss, B.t.u.	.211	.217	.223	.230	
2	No outer layer	2	Efficiency %	82.30	85.09	87.15	88.68	2 1/2	4	Efficiency %	95.03	95.79	96.34	96.73	97.14	97.53	
			Heat Loss, B.t.u.	.670	.680	.692	.704					Heat Loss, B.t.u.	.194	.199	.204	.210	
			Efficiency %	84.23	86.78	88.63	90.00		3	4 1/2	Efficiency %	95.43	96.14	96.64	97.01	97.41	
												Heat Loss, B.t.u.	.179	.184	.189	.195	
												Efficiency %	95.79	96.43	96.90	97.23	
Nominal pipe size 1"																	
1 1/2	No outer layer	1 1/2	Heat Loss, B.t.u.	.678	.691	.705	.719	1 1/2	10	2	3 1/2	Heat Loss, B.t.u.	.203	.208	.213	.219	
2	No outer layer	2	Efficiency %	84.04	86.57	88.42	89.78	2 1/2	4	Efficiency %	95.22	95.96	96.50	96.89	97.29	97.68	
			Heat Loss, B.t.u.	.598	.608	.619	.630					Heat Loss, B.t.u.	.185	.190	.195	.201	
			Efficiency %	85.92	88.18	89.83	91.05		3	4 1/2	Efficiency %	95.64	96.31	96.80	97.14	97.54	
												Heat Loss, B.t.u.	.171	.175	.180	.185	
												Efficiency %	95.97	96.60	97.04	97.37	
Nominal pipe size 1 1/4"																	
1 1/2	No outer layer	1 1/2	Heat Loss, B.t.u.	.612	.625	.638	.651	1 1/2	11	2	3 1/2	Heat Loss, B.t.u.	.196	.201	.206	.212	
2	No outer layer	2	Efficiency %	85.59	87.85	89.52	90.75	2 1/2	4	Efficiency %	95.39	96.10	96.62	96.99	97.39	97.78	
			Heat Loss, B.t.u.	.536	.545	.555	.565					Heat Loss, B.t.u.	.178	.183	.188	.193	
			Efficiency %	87.38	89.41	90.88	91.97		3	4 1/2	Efficiency %	95.81	96.45	96.91	97.29	97.68	
												Heat Loss, B.t.u.	.165	.169	.173	.178	
												Efficiency %	96.11	96.72	97.16	97.47	
Nominal pipe size 1 1/2"																	
1 1/2	No outer layer	1 1/2	Heat Loss, B.t.u.	.581	.593	.605	.617	1 1/2	12	2	3 1/2	Heat Loss, B.t.u.	.190	.195	.200	.206	
2	No outer layer	2	Efficiency %	86.32	88.48	90.06	91.23	2 1/2	4	Efficiency %	95.52	96.22	96.72	97.07	97.47	97.86	
			Heat Loss, B.t.u.	.506	.515	.524	.533					Heat Loss, B.t.u.	.173	.177	.182	.187	
			Efficiency %	88.09	89.99	91.39	92.43		3	4 1/2	Efficiency %	95.93	96.57	97.00	97.34	97.74	
												Heat Loss, B.t.u.	.160	.164	.168	.173	
												Efficiency %	96.24	96.82	97.24	97.54	
Nominal pipe size 2"																	
1 1/2	4 1/2	1 1/2	2 1/2	Heat Loss, B.t.u.	.358	.366	.375	.385	1 1/2	14	2	3 1/2	Heat Loss, B.t.u.	.182	.187	.192	.198
				Efficiency %	91.57	92.90	93.84	94.52	2 1/2	4	Efficiency %	95.72	96.37	96.84	97.19	97.59	
				Heat Loss, B.t.u.	.327	.335	.343	.352					Heat Loss, B.t.u.	.166	.170	.175	.180
				Efficiency %	92.30	93.50	94.36	95.00		3	4 1/2	Efficiency %	96.09	96.70	97.12	97.45	
				Heat Loss, B.t.u.	.314	.322	.330	.338					Heat Loss, B.t.u.	.153	.157	.162	.167
				Efficiency %	92.61	93.75	94.58	95.20					Efficiency %	96.40	96.95	97.34	97.63
				Heat Loss, B.t.u.	.303	.311	.319	.327					Heat Loss, B.t.u.	.146	.150	.155	.160
				Efficiency %	92.86	93.96	94.76	95.35					Efficiency %	96.56	97.09	97.45	97.72
				Heat Loss, B.t.u.	.286	.293	.300	.303					Heat Loss, B.t.u.	.138	.142	.146	.151
				Efficiency %	93.26	94.31	95.07	95.62					Efficiency %	96.72	97.23	97.59	97.89
Nominal pipe size 2 1/2"																	
1 1/2	5	1 1/2	2 1/2	Heat Loss, B.t.u.	.327	.335	.343	.352	1 1/2	16	2	3 1/2	Heat Loss, B.t.u.	.176	.181	.186	.191
				Efficiency %	92.30	93.50	94.36	95.00	2 1/2	4	Efficiency %	95.85	96.49	96.95	97.28	97.68	
				Heat Loss, B.t.u.	.297	.304	.312	.321					Heat Loss, B.t.u.	.159	.163	.168	.173
				Efficiency %	93.01	94.10	94.87	95.43					Efficiency %	96.26	96.84	97.24	97.54
				Heat Loss, B.t.u.	.286	.293	.300	.308					Heat Loss, B.t.u.	.146	.150	.155	.160
				Efficiency %	93.26	94.31	95.07	95.62					Efficiency %	96.56	97.09	97.45	97.72
				Heat Loss, B.t.u.	.276	.282	.289	.297					Heat Loss, B.t.u.	.138	.142	.146	.151
				Efficiency %	93.50	94.52	95.25	95.78					Efficiency %	96.72	97.23	97.59	97.89
				Heat Loss, B.t.u.	.259	.265	.272	.280					Heat Loss, B.t.u.	.130	.134	.137	.141
				Efficiency %	93.90	94.86	95.53	96.02					Efficiency %	96.88	97.39	97.75	98.05
Nominal pipe size 3"																	
1 1/2	6	1 1/2	3 1/2	Heat Loss, B.t.u.	.289	.296	.303	.311	1 1/2	17	2	3 1/2	Heat Loss, B.t.u.	.176	.180	.185	.190
				Efficiency %	93.20	94.26	95.01	95.56	2 1/2	4	Efficiency %	95.85	96.51	96.97	97.30	97.70	
				Heat Loss, B.t.u.	.264	.270	.277	.285					Heat Loss, B.t.u.	.158	.162	.167	.172
				Efficiency %	93.78	94.76	95.45	95.94					Efficiency %	96.28	96.86	97.26	97.55
				Heat Loss, B.t.u.	.254	.260	.267	.275					Heat Loss, B.t.u.	.144	.148	.152	.156
				Efficiency %	94.02	94.96	95.61	96.09					Efficiency %	96.62	97.13	97.50	97.78
				Heat Loss, B.t.u.	.244	.250	.257	.265					Heat Loss, B.t.u.	.136	.140	.144	.148
				Efficiency %	94.26	95.15	95.77	96.24					Efficiency %	96.77	97.28	97.64	97.90
				Heat Loss, B.t.u.	.229	.235	.241	.248					Heat Loss, B.t.u.	.128	.132	.136	.140
				Efficiency %	94.61	95.44	96.04	96.48					Efficiency %	96.82	97.32	97.68	97.93
Nominal pipe size 3 1/2"																	
1 1/2	6	1 1/2	2 1/2	Heat Loss, B.t.u.	.287	.294	.301	.309	1 1/2	21	2	3 1/2	Heat Loss, B.t.u.	.168	.172	.177	.182
				Efficiency %	93.24	94.30	95.05	95.60	2 1/2	4	Efficiency %	96.04	96.66	97.10	97.42	97.82	
				Heat Loss, B.t.u.	.259	.265	.272	.280					Heat Loss, B.t.u.	.150	.154	.158	.163
				Efficiency %	93.90	94.86	95.53	96.02					Efficiency %	96.47	97.01	97.41	97.68
				Heat Loss, B.t.u.	.249	.255	.261	.268					Heat Loss, B.t.u.	.137	.140	.144	.148
				Efficiency %	94.14	95.05	95.71	96.19					Efficiency %	96.77	97.28	97.64	97.90
				Heat Loss, B.t.u.	.238	.244	.250	.257					Heat Loss, B.t.u.	.129	.133	.137	.141
				Efficiency %	94.40	95.27	95.90	96.35					Efficiency %	96.82	97.32	97.68	97.93
				Heat Loss, B.t.u.	.223	.228	.234	.241					Heat Loss, B.t.u.	.121	.125	.129	.133
				Efficiency %	94.74	95.58	96.16	96.58					Efficiency %	96.87	97.37	97.73	98.03
Nominal pipe size 4"																	
1 1/2	7	1 1/2	3 1/2	Heat Loss, B.t.u.	.263	.269	.276	.284	1 1/2	23	2	3 1/2	Heat Loss, B.t.u.	.166	.170	.175	.180
				Efficiency %	93.81	94.78	95.47	95.96	2 1/2	4	Efficiency %	96.09	96.70	97.12	97.45	97.85	
				Heat Loss, B.t.u.	.240	.245	.251	.258					Heat Loss, B.t.u.	.148	.152	.156	.160
				Efficiency %	94.35	95.25	95.88	96.33					Efficiency %	96.51	97.05	97.43	97.72
				Heat Loss, B.t.u.	.221	.226	.232	.239					Heat Loss, B.t.u.	.135	.138	.142	.146
				Efficiency %	94.80	95.62	96.19	96.60					Efficiency %	96.82	97.32	97.68	97.93
				Heat Loss, B.t.u.	.206	.211	.217	.223					Heat Loss, B.t.u.	.127	.130	.133	.137
				Efficiency %	95.15	95.90	96.43	96.83					Efficiency %	96.87	97.37	97.73	98.03
Nominal pipe size 4 1/2"																	
1 1/2	7	2	3 1/2	Heat Loss, B.t.u.	.239	.245	.252	.259	1 1/2	33	2	3 1/2	Heat Loss, B.t.u.	.158	.162	.166	.170
				Efficiency %	94.38	95.25	95.86	96.31					Efficiency %	96.28	96.86	97.27	97.58
				Heat Loss, B.t.u.	.218	.224	.230	.237					Heat Loss, B.t.u.	.140	.143	.147	.151
				Efficiency %	94.87	95.65	96.23	96.64					Efficiency %	96.71	97.23	97.58	97.85
				Heat Loss, B.t.u.	.204	.208	.213	.219					Heat Loss, B.t.u.	.127	.130	.133	.137
				Efficiency %	95.20	95.96	96.50	96.89					Efficiency %	97.01	97.48	97.82	98.05



# Superex Combination Insulation (Asbesto-Sponge Felted)

## Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.  
Efficiencies expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of Asbestos-Sponge Felted, inches	Thickness of Asbestos-Sponge Felted, inches	Total thickness of insulation, inches	Temperature of pipe—deg. Fahr.				Thickness of Superex insulation, inches	Pipe size of Asbestos-Sponge Felted, inches	Thickness of Asbestos-Sponge Felted, inches	Total thickness of insulation, inches	Temperature of pipe—deg. Fahr.									
				500 425	600 625	700 625	800 725					500 425	600 625	700 625	800 725						
<b>Nominal pipe size 5"</b>																					
1½	No outer layer	1½		Heat Loss, B.T.U.	.840	.856	.872	.888	1½	8	2	3½	Heat Loss, B.T.U.	.212	.219	.226	.234				
				Efficiency %	80.23	83.37	85.67	87.38					Efficiency %	95.01	95.75	96.47	96.67				
2	No outer layer	2		Heat Loss, B.T.U.	.755	.767	.779	.793				2½	4	Heat Loss, B.T.U.	.194	.201	.208	.215			
				Efficiency %	82.23	85.09	87.20	88.73				3	4½	Heat Loss, B.T.U.	.181	.187	.194	.201			
														Efficiency %	95.74	96.37	96.81	97.14			
<b>Nominal pipe size ¾"</b>																					
1½	No outer layer	1½		Heat Loss, B.T.U.	.752	.767	.782	.797				1½	9	2	3½	Heat Loss, B.T.U.	.202	.208	.215	.222	
				Efficiency %	82.30	85.09	87.15	88.68								Efficiency %	95.24	95.96	96.60	96.84	
2	No outer layer	2		Heat Loss, B.T.U.	.670	.680	.692	.704					2½	4	Heat Loss, B.T.U.	.184	.190	.196	.203		
				Efficiency %	84.23	86.78	88.63	90.00								Efficiency %	95.66	96.31	96.78	97.14	
												3	4½	Heat Loss, B.T.U.	.170	.176	.182	.188			
															Efficiency %	95.99	96.59	97.01	97.33		
<b>Nominal pipe size 1"</b>																					
1½	No outer layer	1½		Heat Loss, B.T.U.	.678	.691	.705	.719				1½	10	2	3½	Heat Loss, B.T.U.	.194	.200	.207	.214	
				Efficiency %	84.04	86.57	88.42	89.78								Efficiency %	95.43	96.12	96.72	96.96	
2	No outer layer	2		Heat Loss, B.T.U.	.598	.608	.619	.630					2½	4	Heat Loss, B.T.U.	.176	.182	.188	.195		
				Efficiency %	85.92	88.18	89.83	91.05								Efficiency %	95.85	96.47	96.91	97.23	
												3	4½	Heat Loss, B.T.U.	.162	.168	.174	.180			
															Efficiency %	96.18	96.74	97.14	97.44		
<b>Nominal pipe size 1¼"</b>																					
1½	No outer layer	1½		Heat Loss, B.T.U.	.612	.625	.638	.651				1½	11	2	3½	Heat Loss, B.T.U.	.188	.194	.200	.207	
				Efficiency %	85.59	87.85	89.52	90.75								Efficiency %	95.57	96.23	96.81	97.06	
2	No outer layer	2		Heat Loss, B.T.U.	.536	.545	.555	.565					2½	4	Heat Loss, B.T.U.	.169	.175	.181	.187		
				Efficiency %	87.38	89.41	90.88	91.97								Efficiency %	96.02	96.60	97.03	97.34	
												3	4½	Heat Loss, B.T.U.	.156	.161	.167	.173			
															Efficiency %	96.33	96.88	97.26	97.54		
<b>Nominal pipe size 1½"</b>																					
1½	No outer layer	1½		Heat Loss, B.T.U.	.581	.593	.605	.617				1½	12	2	3½	Heat Loss, B.T.U.	.182	.188	.194	.200	
				Efficiency %	86.32	88.48	90.06	91.23								Efficiency %	95.72	96.35	96.93	97.16	
2	No outer layer	2		Heat Loss, B.T.U.	.506	.515	.524	.533					2½	4	Heat Loss, B.T.U.	.164	.169	.175	.181		
				Efficiency %	88.09	89.99	91.39	92.43								Efficiency %	96.14	96.72	97.12	97.43	
												3	4½	Heat Loss, B.T.U.	.151	.156	.161	.167			
															Efficiency %	96.44	96.97	97.36	97.63		
<b>Nominal pipe size 2"</b>																					
1½	4½	1	2½	Heat Loss, B.T.U.	.379	.390	.402	.414				1½	13	2	3½	Heat Loss, B.T.U.	.175	.181	.187	.194	
				Efficiency %	91.07	92.43	93.40	94.12								Efficiency %	95.88	96.48	97.03	97.24	
	1½	2½		Heat Loss, B.T.U.	.343	.353	.364	.376					2½	4	Heat Loss, B.T.U.	.158	.164	.170	.176		
				Efficiency %	91.92	93.15	94.02	94.66								Efficiency %	96.28	96.82	97.21	97.50	
	2	3½		Heat Loss, B.T.U.	.312	.322	.332	.343					3	4½	Heat Loss, B.T.U.	.145	.150	.156	.162		
				Efficiency %	92.66	93.75	94.55	95.12								Efficiency %	96.58	97.09	97.44	97.70	
	2½	3½		Heat Loss, B.T.U.	.289	.298	.308	.318				1½	14	2	3½	Heat Loss, B.T.U.	.175	.181	.187	.194	
				Efficiency %	93.20	94.22	94.94	95.48								Efficiency %	95.88	96.48	97.03	97.24	
	3	4½		Heat Loss, B.T.U.	.272	.280	.289	.299					2½	4½	Heat Loss, B.T.U.	.158	.164	.170	.176		
				Efficiency %	93.59	94.57	95.25	95.75								Efficiency %	96.28	96.82	97.21	97.50	
												3	4½	Heat Loss, B.T.U.	.145	.150	.156	.162			
															Efficiency %	96.58	97.09	97.44	97.70		
<b>Nominal pipe size 2½"</b>																					
1½	5	1	2½	Heat Loss, B.T.U.	.348	.356	.365	.375				1½	16	2	3½	Heat Loss, B.T.U.	.169	.175	.181	.187	
				Efficiency %	91.80	93.09	94.00	94.67								Efficiency %	96.02	96.60	97.06	97.34	
	1½	2½		Heat Loss, B.T.U.	.313	.321	.330	.339					2½	4½	Heat Loss, B.T.U.	.152	.157	.163	.169		
				Efficiency %	92.63	93.77	94.58	95.18								Efficiency %	96.42	96.95	97.32	97.60	
	2	3½		Heat Loss, B.T.U.	.284	.292	.300	.309					3	4½	Heat Loss, B.T.U.	.139	.144	.149	.155		
				Efficiency %	93.31	94.33	95.07	95.61								Efficiency %	96.73	97.21	97.55	97.80	
	2½	3½		Heat Loss, B.T.U.	.262	.270	.278	.287													
				Efficiency %	93.83	94.76	95.43	95.92													
	3	4½		Heat Loss, B.T.U.	.245	.253	.261	.269													
				Efficiency %	94.23	95.09	95.72	96.18													
<b>Nominal pipe size 3"</b>																					
1½	6	1	2½	Heat Loss, B.T.U.	.308	.315	.324	.333				1½	17	2	3½	Heat Loss, B.T.U.	.167	.173	.179	.186	
				Efficiency %	92.75	93.88	94.68	95.26								Efficiency %	96.07	96.64	97.14	97.36	
	1½	3½		Heat Loss, B.T.U.	.278	.286	.294	.303					2½	4	Heat Loss, B.T.U.	.149	.155	.161	.167		
				Efficiency %	93.45	94.45	95.17	95.70								Efficiency %	96.49	96.99	97.36	97.63	
	2	3½		Heat Loss, B.T.U.	.253	.261	.269	.278					3	4½	Heat Loss, B.T.U.	.137	.142	.148	.154		
				Efficiency %	94.04	94.94	95.58	96.05								Efficiency %	96.77	97.24	97.57	97.81	
	2½	4½		Heat Loss, B.T.U.	.234	.242	.250	.259													
				Efficiency %	94.49	95.31	95.89	96.32					1½	19	2	3½	Heat Loss, B.T.U.	.163	.168	.174	.180
	3	4½		Heat Loss, B.T.U.	.219	.227	.235	.243									Efficiency %	96.16	96.74	97.19	97.44
				Efficiency %	94.84	95.60	96.14	96.55					2½	4	Heat Loss, B.T.U.	.145	.150	.155	.161		
																Efficiency %	96.58	97.09	97.45	97.71	
												3	4½	Heat Loss, B.T.U.	.133	.138	.143	.148			
																Efficiency %	96.87	97.32	97.65	97.90	
<b>Nominal pipe size 3½"</b>																					
1½	6	1	2½	Heat Loss, B.T.U.	.309	.318	.327	.337				1½	21	2	3½	Heat Loss, B.T.U.	.160	.165	.171	.177	
				Efficiency %	92.72	93.83	94.63	95.20								Efficiency %	96.23	96.80	97.19	97.48	
	1½	2½		Heat Loss, B.T.U.	.275	.284	.293	.302					2½	4	Heat Loss, B.T.U.	.143	.148	.153	.158		
				Efficiency %	93.53	94.49	95.19	95.71								Efficiency %	96.63	97.13	97.49	97.75	
	2	3½		Heat Loss, B.T.U.	.247	.255	.264	.273					3	4½	Heat Loss, B.T.U.	.130	.135	.140	.145		
				Efficiency %	94.18	95.05	95.66	96.12								Efficiency %	96.94	97.38	97.70	97.94	
	2½	3½		Heat Loss, B.T.U.	.227	.235	.243	.252													
				Efficiency %	94.66	95.44	96.01	96.42													
	3	4½		Heat Loss, B.T.U.	.211	.219	.227	.235													
				Efficiency %	95.03	95.75	96.27	96.66													
<b>Nominal pipe size 4"</b>																					
1½	7	1	2½	Heat Loss, B.T.U.	.280	.288	.296	.304				1½	23	2	3½	Heat Loss, B.T.U.	.157	.162	.167	.173	
				Efficiency %	93.40	94.41	95.14	95.68								Efficiency %	96.30	96.86	97.26	97.54	
	1½	3½		Heat Loss, B.T.U.	.253	.261	.269	.277					2½	4	Heat Loss, B.T.U.	.140	.145	.150	.155		
				Efficiency %	94.04	94.94	95.58	96.06								Efficiency %	96.70	97.19	97.54	97.80	
	2	3½		Heat Loss, B.T.U.	.229	.236	.243	.251								Heat Loss, B.T.U.	.128	.132	.137	.142	
				Efficiency %	94.61	95.42	96.01	96.43								Efficiency %	96.99	97.44	97.75	97.98	
	2½	4½		Heat Loss, B.T.U.	.211	.218	.225	.232													
				Efficiency %	95.03	95.77	96.30	96.71													
	3	4½		Heat Loss, B.T.U.	.197	.203	.210	.217													
				Efficiency %	95.36	96.06	96.55	96.92													
<b>Nominal pipe size 4½"</b>																					
1½	7	2	3½	Heat Loss, B.T.U.	.228	.235	.243	.251				1½	33	2	3½	Heat Loss, B.T.U.	.150	.154	.159	.164	
				Efficiency %	94.63	95.44	96.01	96.43								Efficiency %	96.47	97.01	97.39	97.67	
	2½	3½		Heat Loss, B.T.U.	.208	.215	.222	.230					2½	4	Heat Loss, B.T.U.	.133	.137	.141	.146		
				Efficiency %	95.10	95.83	96.35	96.73								Efficiency %					



## J-M Asbestos Blankets

*For temperatures to 950 F*

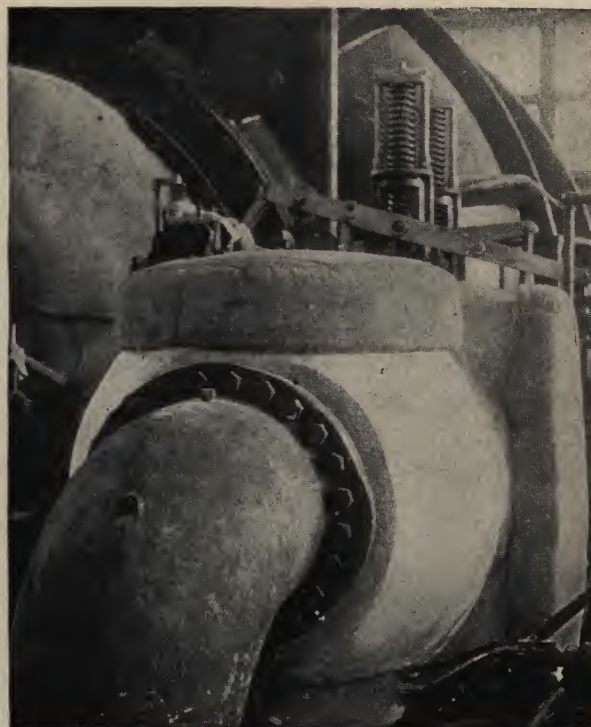
J-M Asbestos Blankets are made of asbestos cloth in envelope form, filled with brown asbestos fiber and tufted with wire at close intervals. Various types of cloth are used depending upon service conditions. The edges and seams are sewed with asbestos cord, either plain or wire-reinforced, using sewed-on monel metal hooks or rings in lieu of holes through the cloth.

Asbestos Blankets meet the demand for removable insulation to give quick accessibility to bolt heads of turbine flanges, fitting flanges and valve bonnets. Also, for oil field boilers, they yield large returns upon the initial investment. Thermal efficiency, durability and ease of removal are the chief advantages.

The following table gives the number of layers of blankets and the thickness of each layer recommended for various temperatures:

Temperature, F	Recommended thickness
Below 338	1½"
338 to 387	2"
388 to 499	2½"
500 to 599	3" (2—1½" layers)
600 to 799	4" (2—2" layers)
800 to 950	4½" (1—2½" and 1—2" layers)

J-M Asbestos Blankets are made to suit each individual case. Recommendations furnished on request.



*J-M Asbestos Blankets used for the removable portions of turbine insulation. Superex Combination Insulation is used on parts where frequent removal is not necessary*

## J-M Asbestos Pipe Blankets

*For temperatures to 950 F*



For pipes requiring frequent inspection and removal of the covering, a blanket form of insulation is far more economical than the moulded type. With the blanket, ease of removal and replacement and the elimination of breakage effect important savings.

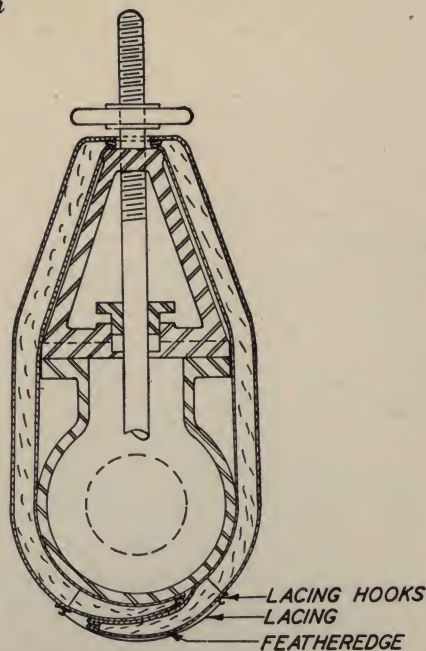
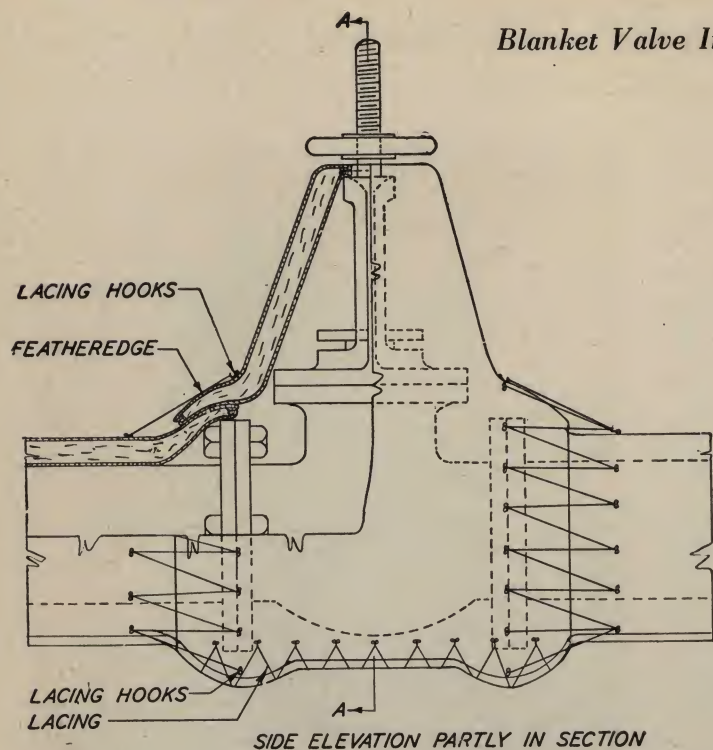
An example of such service is found in oil refineries where hot oil vapor lines, particularly those connecting the cracking coil with the soaking drum, must frequently be inspected.

J-M Asbestos Pipe Blankets are made of asbestos cloth filled with brown asbestos fiber and quilted on approximately 9" centers. Temperature limits run up to 950 F, depending upon the cloth used.

All edges are beveled for a lap joint and sewed with asbestos sewing twine either plain or wire-reinforced. Metal hooks for lacing are secured to all longitudinal edges, on approximate 5" centers, with metal wire and discs.

For single layer blankets the thickness is 2" or 3", and for the double layer blankets, 1½" and 2", the second layer fitting snugly over the first. Pipe blankets



*Blanket Valve Insulation*

are made in sections 3-ft long, with 1-ft sections for breaking joints on two layer construction, and special lengths as required for the particular job. Johns-Manville will recommend, upon application, the proper thickness of insulation and grade of asbestos cloth covering necessary for the conditions involved.

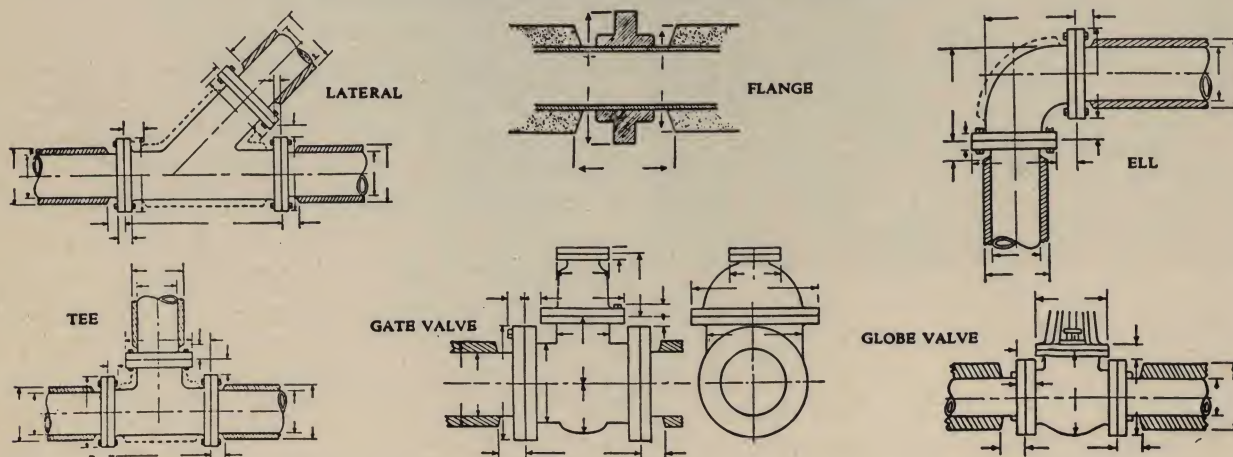
Standard straight blankets are used on pipe bends, but where the radius of the bends is small, the end edges of the blankets are mitered, to make the joints at right angles to the pipe.

**Measurements:** For blankets on ells, crosses, tees and valves, the fittings must be measured exactly as they are shown in the accompanying sketches.

In addition to the measurements, it is desirable to state the class and specification of valves and fittings and the name of the manufacturer of the valves.

The blankets are laced on the pipe or fitting with monel metal wire furnished with the blanket.

For waterproofing pipe blankets, an Asbestos Fire-tard Jacket, cut to fit and wired on, is recommended.

*Measurements to be taken for Pipe Blankets*



# Pre-Shrunk Asbestocel Pipe Insulation

*For temperatures to 300 F*

J-M Pre-Shrunk Asbestocel is a cellular type of insulation, made up of alternate layers of plain and corrugated asbestos felts, for use on pipes conveying low pressure steam and hot water.

This material affords assurance against objectionable shrinkage, the major shortcoming of the old style cellular pipe insulation. The old style material, made of ordinary asbestos paper, readily absorbs moisture ("breathes") while in stock or during handling and consequently expands. After the insulation is applied to a pipe, the heat of the line dries it out, causing the material to shrink and the sections to pull apart at the joints.

Pre-Shrunk Asbestocel, on the other hand, is made of specially-treated, moisture-resistant asbestos paper which prevents "breathing" and thus removes the cause of objectionable shrinkage cracks.

Pre-Shrunk Asbestocel, moreover, is fabricated with an improved type of corrugation which affords greater strength and a more uniform appearance. Because of up-to-date manufacturing facilities, all these advantages are available at no extra cost.



## Finishes

**White Finish:** A glazed white finish, applied directly to the asbestos felt, which offers the following outstanding advantages: A pipe insulation bearing the Underwriters' Laboratories seal of approval as the finish will not carry flames; will not discolor from dampness or contact with wet insulating cement; can be cleaned with a damp cloth; can be painted without preliminary sizing. This pipe covering saves one-third

in application time, compared to regular canvas-covered type, as no pasting is required—a high-speed insulation which slips easily over the pipe and clinches on tight with simple, quick-fastening staples.

**Asbestos-covered high-speed finish:** An attractive asbestos paper finish which, like the White Finish type, saves one-third in application time.

**Regular canvas-covered:** A standard finish used for many years in cellular pipe coverings.

## *Number of feet and sections and approximate gross weight per standard carton*

Nominal Pipe Size, Inches	2-Ply			3-Ply			4-Ply		
	Lin ft of Insulation	No. of 3-ft Sections	Weight, lb Canvas Cover	Lin ft of Insulation	No. of 3-ft Sections	Weight, lb Canvas Cover	Lin ft of Insulation	No. of 3-ft Sections	Weight, lb Canvas Cover
½	180	60	62	120	40	51	84	28	47
¾	150	50	55	108	36	47	72	24	44
1	120	40	51	84	28	43	63	21	42
1¼	90	30	45	72	24	38	51	17	40
1½	84	28	42	60	20	36	45	15	36
2	60	20	38	45	15	32	36	12	34
2½	45	15	31	36	12	31	30	10	37
3	36	12	30	27	9	26	21	7	28
3½	24	8	24	21	7	23	18	6	25
4	33	11	30	27	9	32	21	7	31
4½	24	8	32	21	7	32	18	6	29
5	21	7	35	18	6	25	15	5	28
6	18	6	28	15	5	24	12	4	26



**Sizes and Thicknesses**

Pre-Shrunk Asbestocel is furnished to fit standard pipe sizes, in 3-ft long sections in standard thicknesses of 2 to 8 plies, each ply approximately  $\frac{1}{4}$ " thick. Greater thicknesses can be furnished on order.

Pre-Shrunk Asbestocel can also be supplied in sections to fit straight runs of copper tubing with nominal diameters of  $\frac{3}{8}$ " and up.

**Fine Corrugated Pre-Shrunk Asbestocel**

Pre-Shrunk Asbestocel is also furnished six plies to the inch, with regular canvas jacket, known as Fine Corrugated Pre-Shrunk Asbestocel. The smaller corrugations provide greater strength and efficiency. Standard thicknesses are 4, 6 and 9 plies, each ply approximately  $\frac{1}{6}$ " thick. Other plies can be furnished on special order.

**Pre-Shrunk Asbestocel (sectional) Total Heat Losses**

Expressed in Btu per square foot per degree temperature difference, per hour

Insulation thickness		Temperature of pipe—F					Temperature of pipe—F			
		125	175	225	275		125	175	225	275
		Temperature difference between pipe and air—F					Temperature difference between pipe and air—F			
		50	100	150	200	50	100	150	200	
Nominal pipe size ½"										
2-ply	Heat Loss, Btu	1.020	1.082	1.147	1.215	.633	.675	.719	.765	
3-ply	Heat Loss, Btu	.914	.966	1.020	1.076	.528	.560	.593	.627	
4-ply	Heat Loss, Btu	.847	.894	.943	.944	.458	.486	.515	.544	
Nominal pipe size ¾"										
2-ply	Heat Loss, Btu	.927	.984	1.044	1.107	.622	.664	.708	.754	
3-ply	Heat Loss, Btu	.824	.873	.923	.975	.517	.549	.582	.616	
4-ply	Heat Loss, Btu	.755	.799	.844	.890	.449	.476	.504	.532	
Nominal pipe size 1"										
2-ply	Heat Loss, Btu	.853	.908	.965	1.024	.615	.656	.699	.744	
3-ply	Heat Loss, Btu	.755	.799	.844	.890	.508	.539	.571	.604	
4-ply	Heat Loss, Btu	.684	.724	.765	.807	.438	.465	.493	.521	
Nominal pipe size 1¼"										
2-ply	Heat Loss, Btu	.794	.845	.898	.953	.605	.645	.687	.731	
3-ply	Heat Loss, Btu	.692	.733	.775	.818	.495	.525	.556	.588	
4-ply	Heat Loss, Btu	.623	.660	.698	.736	.425	.451	.477	.504	
Nominal pipe size 1½"										
2-ply	Heat Loss, Btu	.764	.813	.864	.917	.592	.632	.674	.718	
3-ply	Heat Loss, Btu	.660	.699	.739	.780	.484	.514	.545	.577	
4-ply	Heat Loss, Btu	.592	.627	.663	.699	.415	.441	.467	.493	
Nominal pipe size 2"										
2-ply	Heat Loss, Btu	.717	.764	.813	.864	.585	.625	.667	.711	
3-ply	Heat Loss, Btu	.615	.652	.690	.729	.479	.508	.538	.569	
4-ply	Heat Loss, Btu	.547	.580	.613	.647	.409	.434	.459	.485	
Nominal pipe size 2½"										
2-ply	Heat Loss, Btu	.686	.732	.780	.830	.580	.621	.663	.706	
3-ply	Heat Loss, Btu	.586	.619	.654	.691	.470	.499	.529	.560	
4-ply	Heat Loss, Btu	.517	.547	.578	.610	.401	.426	.451	.477	
Nominal pipe size 3"										
2-ply	Heat Loss, Btu	.662	.706	.752	.800	.575	.615	.656	.699	
3-ply	Heat Loss, Btu	.557	.589	.623	.659	.465	.494	.524	.555	
4-ply	Heat Loss, Btu	.489	.518	.548	.578	.398	.421	.445	.470	
Nominal pipe size 3½"										
2-ply	Heat Loss, Btu	.645	.688	.733	.780	.565	.604	.645	.688	
3-ply	Heat Loss, Btu	.540	.573	.607	.642	.457	.486	.516	.547	
4-ply	Heat Loss, Btu	.471	.500	.529	.559	.390	.414	.438	.463	
Nominal pipe size 4"										
2-ply	Heat Loss, Btu	.633	.675	.719	.765	.622	.664	.708	.754	
3-ply	Heat Loss, Btu	.528	.560	.593	.627	.517	.549	.582	.616	
4-ply	Heat Loss, Btu	.458	.486	.515	.544	.449	.476	.504	.532	
Nominal pipe size 4½"										
2-ply	Heat Loss, Btu	.622	.664	.708	.754	.615	.656	.699	.744	
3-ply	Heat Loss, Btu	.517	.549	.582	.616	.508	.539	.571	.604	
4-ply	Heat Loss, Btu	.449	.476	.504	.532	.438	.465	.493	.521	
Nominal pipe size 5"										
2-ply	Heat Loss, Btu	.615	.656	.699	.744	.605	.645	.687	.731	
3-ply	Heat Loss, Btu	.508	.539	.571	.604	.495	.525	.556	.588	
4-ply	Heat Loss, Btu	.438	.465	.493	.521	.425	.451	.477	.504	
Nominal pipe size 6"										
2-ply	Heat Loss, Btu	.605	.645	.687	.731	.592	.632	.674	.718	
3-ply	Heat Loss, Btu	.495	.525	.556	.588	.484	.514	.545	.577	
4-ply	Heat Loss, Btu	.425	.451	.477	.504	.415	.441	.467	.493	
Nominal pipe size 7"										
2-ply	Heat Loss, Btu	.592	.632	.674	.718	.585	.625	.667	.711	
3-ply	Heat Loss, Btu	.484	.514	.545	.577	.479	.508	.538	.569	
4-ply	Heat Loss, Btu	.415	.441	.467	.493	.409	.434	.459	.485	
Nominal pipe size 8"										
2-ply	Heat Loss, Btu	.585	.625	.667	.711	.580	.621	.663	.706	
3-ply	Heat Loss, Btu	.479	.508	.538	.569	.470	.499	.529	.560	
4-ply	Heat Loss, Btu	.409	.434	.459	.485	.401	.426	.451	.477	
Nominal pipe size 9"										
2-ply	Heat Loss, Btu	.580	.621	.663	.706	.575	.615	.656	.699	
3-ply	Heat Loss, Btu	.470	.499	.529	.560	.465	.494	.524	.555	
4-ply	Heat Loss, Btu	.401	.426	.451	.477	.398	.421	.445	.470	
Nominal pipe size 10"										
2-ply	Heat Loss, Btu	.575	.615	.656	.699	.565	.604	.645	.688	
3-ply	Heat Loss, Btu	.465	.494	.524	.555	.457	.486	.516	.547	
4-ply	Heat Loss, Btu	.398	.421	.445	.470	.390	.414	.438	.463	
Nominal pipe size 12"										
2-ply	Heat Loss, Btu	.565	.604	.645	.688	.565	.604	.645	.688	
3-ply	Heat Loss, Btu	.457	.486	.516	.547	.457	.486	.516	.547	
4-ply	Heat Loss, Btu	.390	.414	.438	.463	.390	.414	.438	.463	



# Fibrocel Pipe Insulation

*For temperatures between 35 and 300 F*

Fibrocel® is a molded silica insulation especially developed by Johns-Manville for use on hot, cold and chilled water lines, low-pressure steam pipes, and dual-service heating and cooling pipes.

The outstanding qualities of this new, lightweight, inorganic, low-pressure insulation are extremely low drying shrinkage, firm hard texture, dimensional stability, thermal effectiveness, economy of application and resistance to decay, fire and vermin.

## Styles and Applications

To meet the different temperature and service requirements, Fibrocel is furnished in three jacket styles:

**Fibrocel C for Steam, Hot and Cold Water:** Furnished with standard or special weight canvas jacket and metal bands—for service from 60 to 300 F.

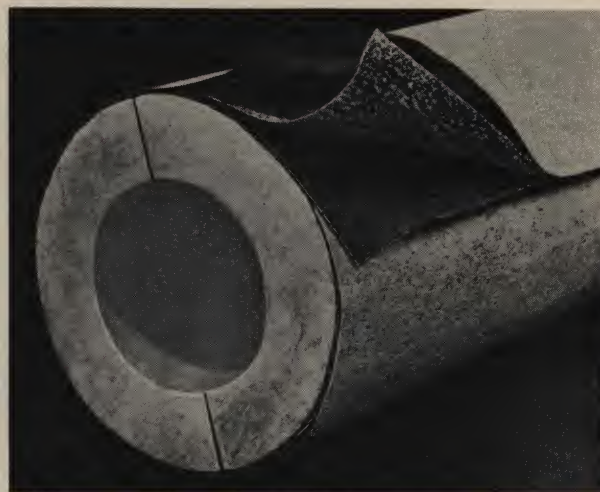
**Fibrocel G for Steam, Hot and Cold Water:** Furnished with glazed white plastic-coated paper jacket and metal bands—for service from 60 to 300 F.

**Fibrocel VB for Chilled Water or Dual Service:** Furnished with a vapor-barrier (VB) jacket consisting of metal foil faced on both sides with creped natural kraft paper, bonded together with a special non-asphaltic waterproof laminant. Presents an attractive mottled finish which may be painted if desired. End strips furnished for sealing joints. The Fibrocel VB jacket has an exceptionally low water vapor transmission rate. It is flame proof and complies with TAPPI, T461m-48 and ASTM, D777-46 for flammability of treated paper and paperboard. . . . Fibrocel VB is recommended for use on pipes subject to sweating and is particularly adapted for dual service heating and cooling systems operating between 35 and 225 F.

## Physical and Thermal Properties\*

Density, lb per cu ft . . . . .	9
Transverse Strength (Modulus of Rupture), psi . . . . .	50
Linear Shrinkage (moist to dry) per 36" length, inches . . . . .	0.05
Service Temperature Range, F . . . . .	35 to 300
Conductivity, Btu in. per sq ft per F per hr at mean temperature	
50 F	100 F
0.34	0.36
150 F	200 F
0.39	0.41

\* The figures given are average values obtained in accordance with accepted test methods.



*A section of Fibrocel VB jacket partially delaminated to show foil sandwiched between outer layers of creped natural kraft*

## Recommended Thicknesses

Nominal Pipe Size, Inches	Temperature of Pipe, F					
	35 to 39	40 to 49	50 to 59	†60 to 99	100 to 199	200 to 300
	Nominal Thickness, Inches			Nominal Thickness, Inches		
	*Fibrocel VB			**Fibrocel C (or G)		
3/8 to 1 1/2	1	3/4	3/4	3/4	3/4	3/4
2 to 3	1	1	3/4	3/4	3/4	1
3 1/2 to 6	1 1/2	1	1	1	1	1
Over 6	1 1/2	1 1/2	1	1	1	1

† On cold water service pipes in crawl spaces over earth floors or in other locations such as laundries, where unusually high humidity can occur, Fibrocel VB should be used.

\* Thicknesses are calculated to prevent condensation (A.S.H.V.E. Guide) at ambient conditions of 85F dry bulb and 80% R.H. (dew point 78F). This provides a factor of safety over design temperatures recommended in A.S.R.E. Handbook for such locations as Houston, Tex., Savannah, Ga., and Washington, D. C., with dew points of 72F.

\*\* Thicknesses are optimum, calculated on an economic basis for heat conservation under average operating conditions.

## Sizes, Accessories and Packaging

Fibrocel Pipe Insulation is supplied in sections 3-ft long and nominal thicknesses of 3/4", 1", 1 1/2" and 2".

Minimum sizes are 1/2" for steel pipe and 3/8" for copper tubing. Consult J-M for complete range of sizes available. All sizes are packaged in cartons designed to meet standard handling and shipping requirements.

**VB Adhesive:** This adhesive is recommended for sealing the Fibrocel VB jacket. It provides a quick initial tack, a permanent bond, and will not stain the jacket. The adhesive is also non-inflammable and water-resistant. VB Adhesive should be protected from freez-



ing and has a recommended inventory life of two months. Average coverage is 50 sq ft per lb. It weighs approximately 9½ lb per gal.

**VB Jacketing Material:** The same jacketing material that is integrally applied to Fibrocel VB. It is supplied in 36"-wide rolls, each containing 1000 sq ft.

## Heat Transmission

Btu per linear foot per hour

Nom- inal pipe or tubing size, inches	Temperature of pipe—F							Nom- inal pipe or tubing size, inches	Temperature of pipe—F						
	40	60	100	150	200	250	300		40	60	100	150	200	250	300
	Temperature difference between pipe and air—F								Temperature difference between pipe and air—F						
	35	15	25	75	125	175	225		35	15	25	75	125	175	225
Nominal ¾" Thickness								Nominal 1" Thickness							
¾ Copper	3.67	1.61	2.75	8.47	14.9	21.6	28.9	¾ Copper	3.35	1.21	2.49	7.77	13.4	19.4	25.9
½ Steel	4.64	2.01	3.47	10.8	18.7	27.2	36.3	½ Steel	4.56	1.89	3.27	10.2	17.7	25.4	33.9
½ Copper	4.00	1.75	2.98	9.32	16.2	23.5	31.2	½ Copper	3.77	1.65	2.81	8.78	15.2	22.0	29.4
¾ Steel	5.63	2.43	4.20	13.0	22.9	33.3	44.4	¾ Steel	4.95	2.16	3.69	11.6	20.2	29.1	38.5
¾ Copper	4.83	2.09	3.59	11.2	19.5	28.2	37.8	¾ Copper	4.48	1.96	3.32	10.4	17.4	26.1	34.7
1 Steel	6.46	2.81	4.84	15.0	26.4	38.5	50.6	1 Steel	5.54	2.41	4.14	12.9	22.3	32.4	43.1
1 Copper	5.57	2.43	4.24	13.1	22.7	33.0	40.4	1 Copper	5.14	2.25	3.83	11.9	20.9	30.4	39.9
1¼ Steel	7.49	3.25	5.63	17.5	30.7	44.7	59.5	1¼ Steel	6.57	2.87	4.93	15.2	26.6	38.5	51.3
1¼ Copper	6.27	2.89	4.69	14.6	25.6	37.3	49.4	1¼ Copper	5.75	2.52	4.27	13.3	23.1	33.7	44.9
1½ Steel	8.16	3.53	6.13	19.1	33.5	48.7	64.9	1½ Steel	7.13	3.10	5.33	16.6	28.7	41.8	55.8
1½ Copper	7.36	3.18	5.52	17.1	30.2	43.8	58.3	1½ Copper	6.43	2.80	4.79	14.9	26.1	37.8	49.0
2 Steel	9.55	4.13	7.13	22.4	38.9	57.1	75.4	2 Steel	8.22	3.57	6.11	19.1	33.1	48.0	64.2
2 Copper	8.85	3.82	6.63	20.7	36.1	52.7	70.1	2 Copper	7.78	3.39	5.81	18.0	31.6	45.9	60.7
2½ Steel	10.9	4.77	8.26	25.8	45.2	66.2	87.8	2½ Steel	9.29	4.03	6.94	21.6	37.6	54.5	73.2
2½ Copper	10.6	4.53	7.88	27.0	43.6	59.2	84.2	2½ Copper	9.01	4.17	6.67	20.8	36.5	52.8	70.4
3 Steel	13.0	5.60	9.72	30.7	53.3	78.0	104	3 Steel	11.2	4.85	8.38	26.2	45.7	66.3	88.0
3 Copper	12.0	5.20	9.06	28.9	49.2	72.0	96.2	3 Copper	9.97	4.33	7.49	23.2	40.4	58.7	78.1
3½ Steel	14.7	6.34	10.8	34.4	59.3	87.7	116	3½ Steel	12.2	5.32	9.10	28.3	49.7	71.9	96.1
4 Steel	15.7	6.75	11.7	36.9	64.0	93.7	125	4 Steel	13.6	5.91	10.2	31.9	55.6	80.7	107
4½ Steel	17.2	7.39	12.8	40.4	71.7	103	137	4½ Steel	14.6	6.38	10.9	34.0	59.2	86.0	115
5 Steel	19.4	8.41	14.4	45.7	80.0	116	155	5 Steel	16.0	6.93	11.9	37.1	65.1	94.2	125
6 Steel	22.7	9.82	16.8	53.2	91.8	135	182	6 Steel	18.7	8.13	14.0	43.6	76.8	111	147
8 Steel	—	—	—	—	—	—	—	8 Steel	23.6	9.92	17.6	54.8	96.7	140	186
10 Steel	—	—	—	—	—	—	—	10 Steel	29.1	12.5	21.5	67.2	118	169	227
12 Steel	—	—	—	—	—	—	—	12 Steel	33.8	14.6	24.9	78.3	138	196	264
Nominal 1½" Thickness								Nominal 2" Thickness							
¾ Copper	2.89	1.27	2.13	6.68	11.6	16.8	23.7	¾ Copper	2.67	1.16	1.97	6.13	10.5	15.3	20.3
½ Steel	3.63	1.58	2.70	8.41	14.5	21.1	27.9	½ Steel	3.33	1.44	2.47	7.67	13.2	19.2	25.5
½ Copper	3.12	1.38	2.30	7.20	12.6	18.2	25.6	½ Copper	2.92	1.27	2.16	6.68	11.5	16.8	22.3
¾ Steel	4.17	1.83	3.11	9.68	16.7	24.1	32.1	¾ Steel	3.80	1.70	2.80	8.78	15.2	22.0	30.5
¾ Copper	3.69	1.62	2.75	8.53	14.9	21.6	28.5	¾ Copper	3.36	1.47	2.50	7.74	13.4	19.4	25.8
1 Steel	4.89	2.14	3.63	11.3	19.7	28.5	37.5	1 Steel	4.10	1.79	3.03	9.47	16.4	23.8	31.5
1 Copper	4.16	1.83	3.09	9.61	16.7	23.6	32.0	1 Copper	3.79	1.66	2.80	8.74	15.0	22.0	29.8
1¼ Steel	5.42	2.37	4.00	12.6	21.7	31.5	41.7	1¼ Steel	4.70	2.05	3.49	10.9	18.8	27.1	36.0
1¼ Copper	4.64	2.03	3.45	10.7	18.6	27.0	35.7	1¼ Copper	4.17	1.83	3.08	9.63	16.7	24.2	32.1
1½ Steel	5.85	2.55	4.34	13.5	23.6	32.6	46.2	1½ Steel	5.02	2.19	3.71	11.6	20.1	29.1	38.6
1½ Copper	5.25	2.30	3.89	12.0	20.9	30.5	40.3	1½ Copper	4.59	2.01	3.40	10.6	18.4	26.7	35.4
2 Steel	6.69	2.93	4.96	15.4	26.8	38.7	52.0	2 Steel	5.74	2.50	4.26	13.2	23.0	33.4	43.9
2 Copper	6.17	2.70	4.59	14.2	24.8	36.0	47.8	2 Copper	5.37	2.35	3.98	12.4	21.5	31.2	41.3
2½ Steel	7.55	3.30	5.62	17.5	30.4	44.0	58.2	2½ Steel	6.33	2.78	4.72	14.7	25.5	37.0	49.0
2½ Copper	7.04	3.11	5.27	16.3	29.0	40.9	54.8	2½ Copper	6.07	2.68	4.51	14.0	24.5	35.3	46.9
3 Steel	8.85	3.87	6.58	20.5	35.6	51.2	68.2	3 Steel	7.31	3.21	5.45	16.9	29.3	42.4	56.3
¾ Copper	8.06	3.51	5.99	18.6	32.2	46.6	62.3	¾ Copper	6.20	2.95	4.99	15.6	27.1	39.4	52.0
3½ Steel	9.71	4.25	7.24	22.5	39.2	56.2	73.6	3½ Steel	8.07	3.55	6.00	18.6	32.4	47.1	61.9
4 Steel	10.6	4.63	7.86	24.6	42.5	61.4	82.0	4 Steel	8.84	3.88	6.57	20.4	35.4	51.1	68.0
4½ Steel	11.4	4.96	8.40	26.4	45.6	65.9	88.0	4½ Steel	9.66	4.22	7.17	22.3	38.7	56.2	74.0
5 Steel	12.5	5.45	9.30	29.1	50.4	72.9	97.5	5 Steel	10.2	4.44	7.56	23.6	40.8	59.2	78.1
6 Steel	17.4	7.61	12.9	40.5	70.0	101	135	6 Steel	11.9	5.14	8.82	27.3	47.6	69.0	91.2
8 Steel	20.9	9.13	15.5	48.9	84.5	122	162	8 Steel	14.6	6.37	10.8	33.7	58.4	85.2	113
10 Steel	24.8	10.8	18.5	58.2	101	145	194	10 Steel	17.6	7.69	13.0	40.6	70.7	102	136
12 Steel	28.4	12.4	21.1	66.4	115	166	221	12 Steel	20.2	8.90	15.1	46.9	83.3	118	157



# J-M Pre-Shrunk Wool Felt Pipe Insulation

## For hot and cold water service lines

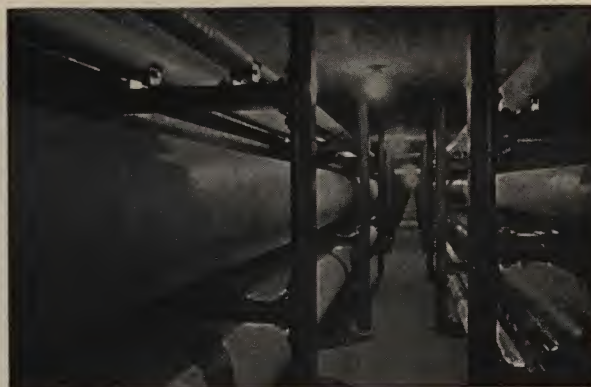
*Temperatures between 60 and 225 F—Canvas Finish*

*Temperatures between 45 and 60 F—Integral Jacket*

To promote quicker delivery of water of the desired temperature at the faucet and to prevent sweating of cold water lines, insulation of hot and cold water service lines is highly desirable. The convenience and economy which such insulation assures have long been recognized as essential by hotel, apartment house and office building operators and are being more generally demanded by home owners.

J-M Pre-Shrunk Wool Felt Pipe Insulation is an effective and economical material to keep hot water hot and cold water cold, and to prevent sweating of cold water service lines. (See under "Finishes" for temperature limitations.) Like Pre-Shrunk Asbestocel, J-M Pre-Shrunk Wool Felt is made of moisture-resisting felts which reduce absorption of moisture in storage, thus minimizing drying shrinkage and opening of joints after application.

The sheets of wool felt, of which the material is composed, are indented by a special manufacturing process which reduces the conductivity of the finished material



*J-M Pre-Shrunk Wool Felt Pipe Insulation installed on lines in a walking tunnel*

approximately 25 percent as compared with ordinary wool felt. The insulation made with this indented material is also from 16 to 20 percent lighter in weight.

J-M Pre-Shrunk Wool Felt Pipe Insulation has a dual-service liner which is suitable for either hot or cold-water service.

### **Finishes:**

For temperatures between 60 and 225 F, the pipe insulation is available with a canvas finish. The sections are held tightly in place with bands which are included in each carton. The pipe insulation can also be furnished with an integral weatherproof asbestos jacket attached at the factory.

For temperatures between 45 and 60 F, an integral asphalt-saturated asbestos jacket can be supplied when so ordered to protect the insulation from the infiltration of moisture. This jacket is suitable for intermittently operated equipment. For constant operation, a coat of Zerogloss\* should be applied to the completed installation.

### **Sizes and Thicknesses:**

In both finishes, J-M Pre-Shrunk Wool Felt Pipe Insulation is supplied in sections 3-ft long, in single layer thicknesses of  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1",  $1\frac{1}{2}$ " and 2" and double layer thicknesses of 1",  $1\frac{1}{2}$ " and 2" for pipe sizes of  $\frac{1}{2}$ " and larger. The double layer construction permits all through joints to be staggered. It is also furnished to fit straight runs of copper pipe and tubing of outside diameters from  $\frac{3}{8}$ " up.

\* Zerogloss is a moisture-resistant asphaltic finish having a covering capacity of approximately 100 sq ft per gallon.



*J-M Pre-Shrunk Wool Felt Pipe Insulation showing double-layer construction*



## Pre-Shrunk Wool Felt Pipe Insulation

*Number of Feet and Sections and Approximate Gross Weight per Standard Carton*

Nominal pipe size, inches	½"-Thick Insulation			¾"-Thick Insulation			1"-Thick Insulation		
	Linear feet of insulation	Number of 3-ft sections	Weight, lb Canvas finish	Linear feet of insulation	Number of 3-ft sections	Weight, lb Canvas finish	Linear feet of insulation	Number of 3-ft sections	Weight, lb Canvas finish
½	180	60	80	120	40	72	84	28	75
¾	135	45	69	105	35	72	72	24	65
1	123	41	73	84	28	65	60	20	64
1¼	96	32	67	72	24	66	51	17	60
1½	84	28	70	60	20	62	45	15	60
2	63	21	58	45	15	50	36	12	57
2½	45	15	49	36	12	47	30	10	51
3	36	12	45	27	9	40	21	7	43
3½	27	9	41	21	7	36	18	6	42
4	21	7	38	18	6	35	18	6	44
4½	18	6	25	18	6	37	15	5	41
5	18	6	35	15	5	32	12	4	36
6	15	5	32	12	4	34	12	4	48
8	9	3	23	6	2	23	6	2	30
10	6	2	18	6	2	28	6	2	35

Standard cartons, 20" x 13½" x 36¼", are used for sizes indicated in table.

### J-M Pre-Shrunk Wool Felt Pipe Insulation Heat Losses

Expressed in Btu per linear foot per hour per degree F temperature difference between the pipe and the surrounding air

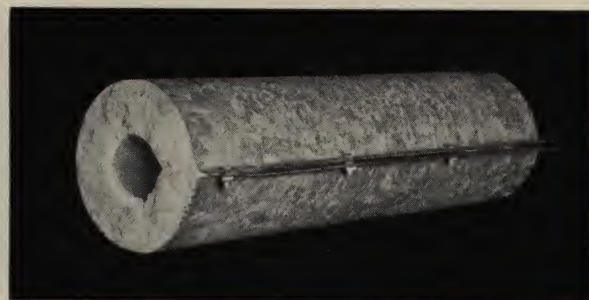
Nominal pipe size, inches	½"-Thick Insulation	¾" Thick Insulation	1"-Thick Insulation	1½"-Thick Insulation
½	.171	.145	.129	.109
¾	.198	.166	.146	.122
1	.231	.191	.166	.137
1¼	.275	.225	.194	.158
1½	.304	.247	.211	.171
2	.362	.292	.248	.197
2½	.423	.337	.285	.224
3	.500	.394	.331	.258
3½	.560	.440	.366	.284
4	.621	.485	.404	.311
4½	.681	.530	.440	.336
5	.748	.581	.482	.365
6	.876	.675	.557	.421
8	1.117	.858	.702	.526
10	1.375	1.048	.856	.634



## Banroc Pipe Insulation



*Style No. 25 shown as it appears when formed for application to pipe*



*Style No. 65 turned sidewise to show the outer casing bolted together along the flange seam*

Banroc® Pipe Insulation is a felted mineral wool fiber insulation which may be used under normal conditions for temperatures up to 1000 F. It is manufactured in two forms: Style No. 25 is enclosed in expanded metal lath and Style No. 65, in a metal jacket.

### *Style No. 25:*

Style No. 25 Banroc Pipe Insulation consists of Banroc secured to expanded metal lath with galvanized tie wires. Because of its great flexibility, it is packaged and shipped flat. It is furnished in straight-line sections only, 24" long, in thicknesses of 1", 1½", 2", 2½", 3" and 4" for all standard pipe sizes 2" in diameter and larger.

Style No. 25 is installed by wrapping around the pipe, with the expanded metal lath outside, and lacing the metal lath together with No. 18 W & M gage galvanized wire.

For interior work, the insulation may be coated with J-M No. 352 (or No. 302) Insulating Cement and finished with an 8 or 6-oz canvas jacket, sized and painted if desired.

For outdoor work, the insulation should be weather-proofed with a Double-Coated Flexstone or Asbestos Firetard jacket.

### *Style No. 65:*

Style No. 65 Banroc Pipe Insulation consists of Banroc secured to a No. 24 U. S. Standard gage galvanized sheet metal outer casing with steel straps crimped in the flanges of the casing. It is especially

suited for pipe lines where an insulation with a fire-proof metal jacket is desired. It is also particularly adapted for use where the insulation must be frequently removed for repairs or for changes in piping layout.

Style No. 65 is furnished in sections 24" long with 2" extra casing length for end laps, in thicknesses of 1", 1½", 2", 2½" and 3" for all standard pipe sizes 2" in diameter and larger; 4" thick in 4", 6", 8", 10" and 12" pipe sizes only. It is also furnished for bends having a radius of at least 1½ times the nominal pipe size but limited to a minimum radius of 12". Thickness limitations on bends are as follows:

2"	maximum thickness for 12" or greater radius of bend								
2½"	"	"	15"	"	"	"	"	"	"
3"	"	"	18"	"	"	"	"	"	"
4"	"	"	21"	"	"	"	"	"	"

On bends having a radius equal to the nominal pipe size, bends with a radius under 12", fittings and special shapes are insulated with sheet-metal boxes filled with loose mineral wool. The boxes are constructed in two sections with a total depth equal to the outside diameter of the pipe, plus twice the specified insulation thickness. Cut-outs are provided to accommodate the pipe or fittings, and the two halves are fastened together with stove bolts fitted through flanges at the edges of the sections.

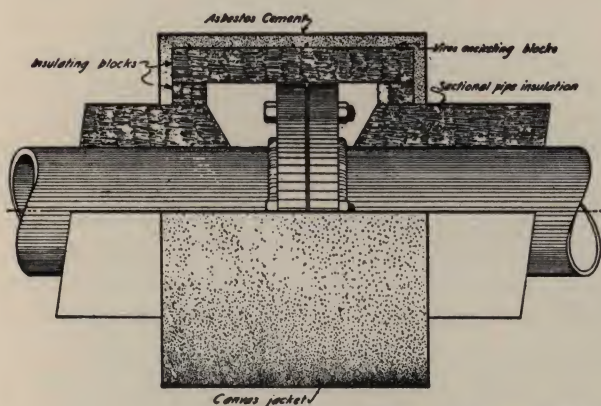
Style No. 65 is installed by spreading and slipping around the pipe. It is then fastened together along the flange seam with ¼"-galvanized stove bolts, the seam being located at the bottom of the pipe.



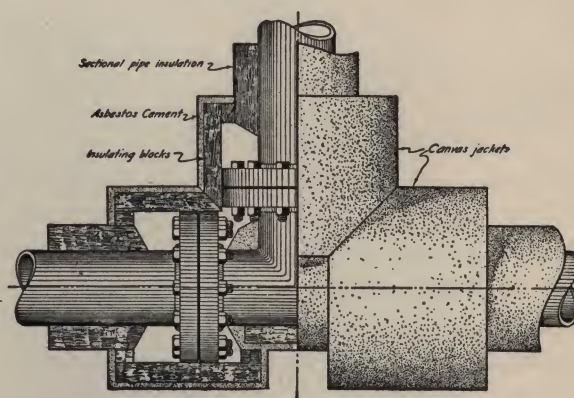




## Insulation Specifications for Flanges, Fittings and Valves



*Permanent type of insulation with insulating blocks*



### *Insulation:*

All flanges, fittings and valves shall be insulated with the same materials as the adjacent piping.

On piping 4" and larger, the bodies of flanged fittings and valves, the entire surface of screwed fittings, the entire surface up to the bonnet of screwed valves, and flanges of all pipe sizes where flange insulation is to be of the permanent type, shall be insulated with block insulation to a thickness  $\frac{1}{2}$ " thinner than the insulation on the adjacent piping. Hard finish Asbestos Cement shall then be applied to make the total thickness of insulation on the valve or fitting equal to that on the adjacent piping. Pipe insulation should be stopped short of all flanges, and beveled off to permit removal of flange bolts when necessary.

In the case of flanges the insulation of which is to be of the removable and replaceable type, all flanges

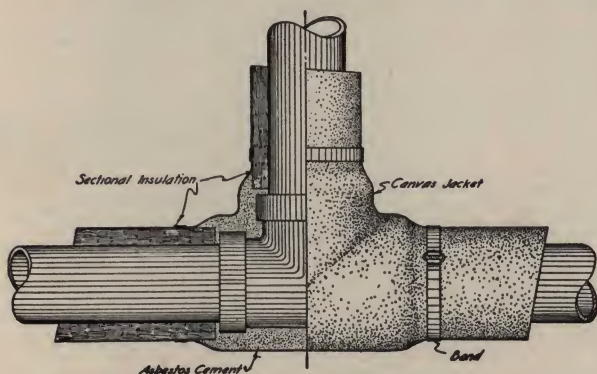
shall be insulated with sectional pipe insulation to a thickness equal to that of the insulation on the adjacent piping or with block insulation to a thickness  $\frac{1}{2}$ " thinner than the insulation on the adjacent piping, covered with  $\frac{1}{2}$ " hard finish Asbestos Cement. Removable flange insulation is applied as described on the next page.

On piping  $3\frac{1}{2}$ " and smaller, in place of blocks and cement as mentioned above, the entire insulation of flanged and screwed fittings and valves shall consist of hard finish Asbestos Cement to a total thickness equal to that of the adjacent pipe insulation.

### *Application—Permanent Type:*

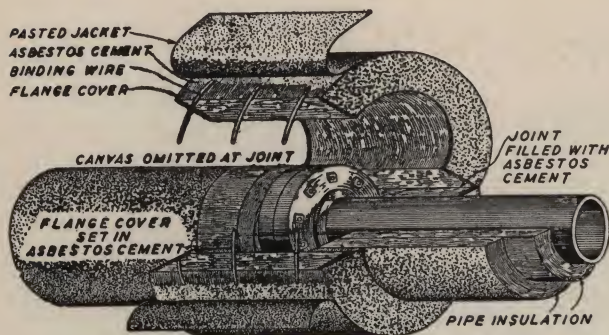
The block insulation on the body of 4" or larger fittings and valves and on all flanges to be insulated with permanent type insulation, shall be securely wired in place with No. 16 gauge annealed iron wire.

On flanges the insulation shall be of such length as to extend not less than 2" over the adjacent pipe insulation on each side of the flange and the space between filled with insulation and thoroughly sealed with hard finish Asbestos Cement. Hard finish Asbestos Cement shall then be applied in two coats to bring the total thickness of the insulation up to that on the adjacent piping. The first coat of cement shall be allowed to dry thoroughly before the second is applied and the second coat shall be troweled to a smooth, hard finish.



*Asbestos cement insulation for small fittings and valves*





Removable and replaceable sectional-type of insulation

#### Application—Removable and Replaceable Type:

On all flanges which are to be insulated with a removable and replaceable type of insulation, where the flange insulation consists of sectional covering, it shall be of suitable size to encircle the flange and of such length that it will, when applied, overlap the adjacent pipe insulation on each end, not less than 2". This sectional covering shall be securely wired in place on the flange and the annular space, if any, between the flange insulation and the insulation on the pipe, shall be filled and thoroughly sealed with hard finish Asbestos Cement. A thin layer of hard finish Asbestos Cement shall then be applied over the entire surface of the flange covering to present a smooth, even finish.

On all flanges which are to be insulated with a removable and replaceable type of insulation, where the flange insulation consists of blocks, they shall be securely wired to a frame made of  $\frac{1}{2}$ " square mesh, 19-gauge galvanized wire cloth. This frame shall be made in two parts and of such size and shape, as to encircle and enclose the blocks on the outside. At the ends of the blocks the wire mesh shall be split and bent down to enclose the hard finish Asbestos Cement used to fill up the annular space between the block insulation and the pipe insulation. The wire frame, with its attached blocks and cement, shall then be wired in place on the flange and the entire cover finished with  $\frac{1}{2}$ " of hard finish Asbestos Cement. The cement shall be applied in two coats, the first of which shall be allowed to dry thoroughly before the second is applied. The second layer shall be troweled to a smooth, even finish.

\* A durable, easily applied, weather-proof coating for insulated surfaces. Furnished in Winter Grade or Summer Grade, in containers of 50, 150 and 500-lb. Applied  $\frac{1}{4}$ " thick, the covering capacity is approximately 55 sq ft per 100 lb.

#### Application on Fittings $3\frac{1}{2}$ " or smaller:

On  $3\frac{1}{2}$ " or smaller valves and fittings, hard finish Asbestos Cement shall be applied to the surface, in layers not thicker than  $\frac{1}{2}$ ", to equal the total thickness of insulation on adjacent piping. Each layer of cement shall be allowed to dry thoroughly before the succeeding layer is applied and the final layer shall be troweled to a smooth, hard finish.

#### Finish:

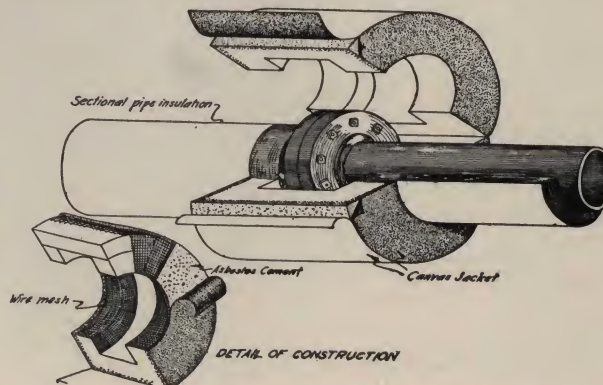
Indoors: The insulation on flanges, fittings and valves located indoors shall be finished with 6-oz canvas stretched tightly over the surface of the insulation and held in place by paste throughout its entire surface. The canvas shall be so cut and stretched that it covers the entire surface of the fitting and presents a smooth, even surface.

Outdoors: All flange, fitting and valve insulation located outdoors shall be finished with J-M Insulkote,\* applied  $\frac{1}{4}$ " thick, in place of the final outer coat of asbestos cement. The cement coat, over which the Insulkote is applied, shall be mixed with portland cement in the proportions of two parts asbestos to one part portland cement by weight and shall be scored and allowed to dry before applying the Insulkote. The Insulkote shall be troweled to a smooth, even finish.

#### Painting:

All flanges, fittings and valves, finished with a jacket of 6-oz canvas, shall be finally painted with first one coat of glue sizing and then not less than two coats of first quality lead and oil paint, of a color selected by the purchaser.

All of the above insulation shall be applied by the manufacturer of the materials used, or the manufacturer's technical service unit.



Removable and replaceable block-type insulation



## J-M Rock Cork Pipe Insulation

J-M Rock Cork® Pipe Insulation and Zerotex® Built-up Fitting Insulation are used on pipe lines carrying ice water, brine, ammonia and other refrigerated fluids. Highly efficient and durable, they combine all of the properties essential to an economical and permanent cold pipe insulation.

Rock Cork and Zerotex for the insulation of pipe lines embody all the desirable features of Rock Cork sheets which have been used with exceptional success in cold storage insulation for over 40 years.

Both the pipe and fitting insulation have a remarkably high resistance to moisture infiltration which causes most cold pipe insulation failures. The integral waterproof jacket provides thorough sealing, further assuring permanence under service conditions.

Rock Cork and Zerotex will not decay nor support the growth of bacteria or mold. The insulations are also odorless and vermin-proof.

### Rock Cork Pipe Insulation

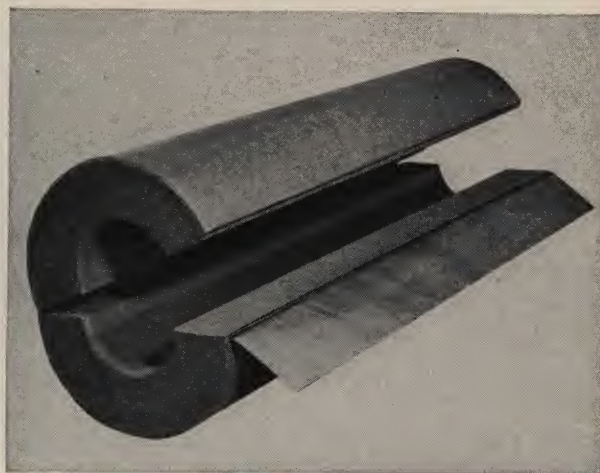
J-M Rock Cork Pipe Insulation is manufactured from Banroc, a mineral wool, which is bonded with a waterproof compound. Furthermore, it is furnished with a factory-applied integral waterproof jacket, in single layer sections, 3-ft long, to fit standard pipe sizes.

The integral waterproof jacket of the sectional pipe insulation protects both longitudinal joints, eliminating dependence upon seam filling compounds. In addition, it increases considerably the speed of application as a complete section can be applied as a unit. When installed, Rock Cork Pipe Insulation provides an unbroken, seamless sheath which is highly efficient as a barrier to the flow of heat.

Rock Cork Lagging, used as an outer application over the sectional insulation for very low temperature work, is supplied 1½-ft and 3-ft long depending upon pipe size and thickness of the lagging. It is furnished 1½", 2", 3" and 4" thick. Lagging is also used on very large pipe, small tanks and cylinders.

On special order the insulation can be supplied to fit straight runs of ¼" to 4" brass and copper tubing. Outside diameter of tubing must be stated in the order.

A definite thickness of insulation is supplied for each size of pipe according to the individual service requirements. For certain pipe sizes, the insulation is



*The integral waterproof jacket affords tighter joints and facilitates the application of the insulation*

furnished in sectional form, hinged; other sizes in two separate half sections (see table following).

When other conditions prevail, recommendations should be secured from Johns-Manville.

### Service Recommendations:

Ice Water thickness is used for water, liquid ammonia and other cold lines between 30 and 45 F. It varies in thickness as shown in the following table.

Brine thickness is used for pipes conveying brine, ammonia and other cold lines operating between 0 to 30 F. It varies in thickness as indicated in the following table.

Heavy Brine thickness is used for pipes conveying brine, ammonia or other refrigerants operating at temperatures from 0 to -30 F. The thickness varies as indicated in the following table.

Temperature below -30 F: On pipe lines operating at temperatures below -30 F, the choice of proper thickness depends upon such a number of varying factors that recommendations should be obtained from Johns-Manville.

However, under certain conditions, the following thicknesses of J-M Rock Cork Lagging over Heavy Brine thickness have been used: From -30 to -50 F, 1½" lagging for pipe sizes 1¼" to 4" and 2" lagging for pipe sizes over 4". For service temperatures ranging from -50 to -70 F, 2" lagging for pipe sizes from 1¼" to 4" and 3" lagging for pipe sizes over 4".



**Zerotex Built-up Fitting Insulation**

All fittings are insulated with J-M Zerotex, a felted mineral wool, combined in production with a water-resistant binder. Zerotex is furnished in blankets 15" wide by 48" in length with a nominal thickness of 2". During application the thickness is reduced somewhat as the material is secured in place.

To apply the felt to a fitting, a piece, slightly larger than the circumference of the fitting, should be cut from the sheet. The Zerotex should then be placed on the fitting and secured with jute twine. One to four layers may be required depending upon the thickness desired. Additional pieces of Zerotex should be cut and stuffed into low spots in the fitting to assure the proper thickness.

Each layer of the fitting insulation is covered with a double-wrapping of Zerotape, all pores of which are closed by a brushing of Zeroseal.

Zerotex Built-up Fitting Insulation has proved its worth under service conditions for an extended period of time. It offers decided advantages over rigid or pre-cast types of fitting insulation. The material can be readily adapted to any style of fitting with complete assurance of a tight, moisture-proof installation. Since all fittings are insulated with the same material, the necessity of maintaining expensive stocks of fitting jackets is eliminated.

**Accessories**

The following J-M materials are required in the application of Rock Cork Pipe Insulation:

**Zeroseal:** A fibrated solvent asphalt used to seal joints of the insulation and to close all pores in the sealing membrane of Zerotape which is applied over Zerotex on fittings. Zeroseal is furnished in various sized gallon containers. One gal weighs approximately 9 to 10 lb.

**Zerotape:** A high-grade waterproof fabric used as a sealing membrane over Zerotex on fittings and over end joints on pipe insulation. It is furnished in 1½" and 3"-wide rolls, 40-ft long.

**Zerogloss:** A smooth-bodied asphalt compound which is used to give a bright black protective finish to the entire installation, both pipe and fittings. It is furnished in various sized gallon containers. One gallon covers approximately 100 sq ft.

Sufficient Zeroseal®, Zerotape® and Zerogloss®, as well as copperized staples and copper-covered annealed steel wire, are shipped with the pipe insulation for use in applying the material in accordance with application directions. If specified, galvanized steel straps and seals will be furnished instead of wire.

Zerotex and accessories for insulating fittings should be ordered separately.

**Thicknesses and List prices of Rock Cork Pipe Insulation per linear foot**

Nominal size, pipe inches	Actual O. D. pipe, inches	Ice Water Thickness			Brine Thickness			Heavy Brine Thickness		
		O. D. insulation, inches	Thickness of insulation, inches	List price per lin ft	O. D. insulation, inches	Thickness of insulation, inches	List price per lin ft	O. D. insulation, inches	Thickness of insulation, inches	List price per lin ft
¼	0.540	3.5	1.45	\$1.00	4.5	1.98	\$1.25	6.5	2.97	\$2.10
⅜	0.675	3.5	1.40	1.00	4.5	1.91	1.25	6.5	2.90	2.10
½	0.840	4.0	1.58	1.00	5.0	2.08	1.25	6.5	2.82	2.10
¾	1.050	4.5	1.72	1.05	5.0	1.97	1.35	7.0	2.97	2.25
1	1.315	4.5	1.59	1.20	5.5	2.09	1.55	7.5	3.09	2.60
1¼	1.666	5.0	1.67	1.25	6.5	2.42	2.00	8.0	3.16	2.90
1½	1.900	5.0	1.52	1.40	7.0	2.55	2.25	8.5	3.30	3.00
2	2.375	5.5	1.55	1.55	7.5	2.56	2.35	9.0	3.31	3.50
2½	2.875	6.0	1.56	1.65	8.0	2.56	2.70	9.5	3.31	3.85
3	3.500	6.5	1.50	1.85	9.0	2.75	3.30	10.5	3.49	4.30
3½	4.000	7.0	1.50	2.25	10.0	3.00	3.65	11.0	3.50	5.00
4	4.500	8.0	1.75	2.55	10.5	2.97	3.95	12.0	3.75	5.50
4½	5.000	8.5	1.75	2.90	11.0	3.00	4.40	12.5	3.75	6.00
5	5.563	9.0	1.72	3.50	11.5	2.99	4.80	13.5	3.97	6.75
6	6.625	10.0	1.68	4.20	13.0	3.19	5.30	14.5	3.92	7.80
7	7.625	11.5	1.93	4.80	13.5	2.93	6.20	15.5	3.93	9.00
8	8.625	12.5	1.94	5.50	15.0	3.19	6.80	17.0	4.18	10.00
9	9.625	13.5	1.93	6.30	15.5	2.93	7.90	18.0	4.18	11.00
10	10.750	14.5	1.87	7.00	17.0	3.12	9.00	19.0	4.12	12.00
12	12.750	16.5	1.87	8.00	19.0	3.12	10.50	20.7	4.00	14.00

Sizes above horizontal rule are furnished in sectional form, hinged. Sizes below line are furnished in two separate half sections. Prices include accessories. Fitting Insulation not included.



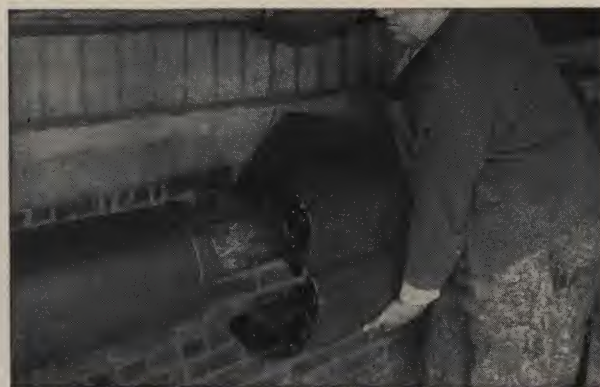
## Application of J-M Rock Cork Pipe Insulation

Proper application is equally as important as proper materials in the success of refrigerated pipe insulation. J-M Rock Cork Pipe Insulation, properly installed, will give satisfaction over a long period.

### Spacing of the Lines:

Sufficient space must be allowed between pipes and adjacent surfaces to permit easy application of the full thickness of insulation. Dimensions required for the minimum spacing of pipe lines follow:

Insulation thickness	Space required between parallel pipes, inches	Space required between pipe and adjacent surfaces, inches
<b>Ice Water Thickness</b>		
Up to 6" pipe—screwed fittings....	7	5
Larger than 6" pipe—screwed fittings	11	6
All pipe sizes—flanged fittings.....	12	8
<b>Brine Thickness</b>		
Up to 6" pipe—screwed fittings....	9	7
Larger than 6" pipe—screwed fittings	15	9
All pipe sizes—flanged fittings.....	16	10
<b>Heavy Brine Thickness</b>		
Up to 3" pipe—screwed fittings....	11	9
Larger than 3" pipe—screwed fittings	19	13
All pipe sizes—flanged fittings.....	20	14



Rock Cork Pipe Insulation is easily and quickly applied

### Preparation of Lines:

Before any insulation is applied, pipe and fittings must be tested, made tight, cleaned of rust, scale or other foreign matter, freed of frost and made dry.

All pipe should be hung on metal saddles placed over the insulation. A sheet metal shield, at least as long as the outside diameter of the insulation and extending half way up on each side, should be snugly fitted under the line at each hanger-point.

Lines may be supported on wood blocks set in hangers until the insulation is ready to be applied.

### Rates of heat transmission

The rates of heat transmission given below are expressed in Btu per square foot (and also per linear foot), per hour, per degree temperature difference between fluid in the pipe and air surrounding the pipe. In the case of screwed fittings, where the proportion of fittings to pipe is not unusually high, no great error will be introduced by figuring small fittings, such as ells and tees, as one linear foot of pipe; and larger fittings, valves, crosses, etc., as one and one-half linear feet. Reference to a table of areas will be necessary in computing radiation equivalent for flanged fittings. Such a table appears on another data sheet.

Pipe size, inches	Ice Water Thickness			Brine Thickness			Heavy Brine Thickness		
	Btu per lin ft	Btu per sq ft pipe surface	Btu per sq ft outer surface	Btu per lin ft	Btu per sq ft pipe surface	Btu per sq ft outer surface	Btu per lin ft	Btu per sq ft pipe surface	Btu per sq ft outer surface
1/2	.110	.502	.105	.098	.446	.075	.087	.394	.051
3/4	.119	.431	.101	.111	.405	.085	.094	.340	.051
1	.139	.403	.118	.124	.352	.086	.104	.294	.053
1 1/4	.155	.357	.118	.131	.300	.077	.113	.260	.054
1 1/2	.174	.351	.133	.134	.270	.073	.118	.238	.053
2	.200	.322	.139	.151	.244	.077	.134	.214	.057
2 1/2	.228	.303	.145	.170	.226	.081	.147	.197	.059
3	.269	.293	.158	.186	.202	.079	.162	.176	.059
3 1/2	.295	.282	.161	.191	.183	.073	.176	.167	.061
4	.294	.248	.140	.209	.176	.076	.182	.154	.058
5	.349	.239	.148	.241	.165	.080	.202	.138	.057
6	.404	.233	.154	.259	.150	.076	.228	.130	.060
8	.455	.201	.139	.318	.140	.081	.263	.116	.059
10	.559	.198	.147	.383	.135	.086	.309	.110	.062
12	.648	.194	.150	.438	.131	.088	.364	.108	.067
14	.670	.182	.142	.487	.132	.093	.392	.107	.068
16	.750	.179	.143	.542	.130	.094	.434	.104	.069
18	.833	.176	.145	.604	.127	.096	.476	.102	.070
20	.919	.175	.146	.661	.126	.097	.520	.100	.071



## Prevention of Freezing in Water Pipes

It is impossible for any type or thickness of insulation to prevent the freezing of water in pipes if there is no flow and surrounding temperatures remain low for a sufficient length of time, since no insulation will completely prevent heat flow. The following table is based upon the use of Rock Cork Pipe Insulation and indicates the proper insulation thickness to use where conditions are known or can be assumed with reasonable accuracy.

*Data on Freezing of Water in Pipes\**

Steel Pipe size, inches	Rock Cork, Insulation thickness	Btu per deg temp. diff., per hour per lin ft	Hours to cool from 42 to 32 F No flow	Lb water flow per hr per lin ft to prevent freezing
1/2	Ice Water	0.110	0.43	0.63
	Brine	0.098	0.52	0.56
	Heavy Brine	0.087	0.73	0.50
1	Ice Water	0.139	0.78	0.79
	Brine	0.124	0.90	0.71
	Heavy Brine	0.104	1.20	0.59
1 1/2	Ice Water	0.174	1.27	0.98
	Brine	0.134	1.72	0.76
	Heavy Brine	0.118	2.04	0.67
2	Ice Water	0.200	1.69	1.14
	Brine	0.151	2.31	0.86
	Heavy Brine	0.134	2.71	0.76
3	Ice Water	0.269	2.73	1.53
	Brine	0.186	4.02	1.06
	Heavy Brine	0.162	4.68	0.93
4	Ice Water	0.294	4.08	1.68
	Brine	0.209	5.84	1.19
	Heavy Brine	0.182	6.77	1.04
6	Ice Water	0.404	6.45	2.30
	Brine	0.259	10.01	1.48
	Heavy Brine	0.228	11.61	1.30
8	Ice Water	0.455	9.75	2.60
	Brine	0.318	14.00	1.82
	Heavy Brine	0.263	17.00	1.50
10	Ice Water	0.559	12.22	3.20
	Brine	0.383	17.95	2.20
	Heavy Brine	0.309	22.32	1.76
12	Ice Water	0.648	14.80	3.70
	Brine	0.438	22.12	2.50
	Heavy Brine	0.364	26.80	2.08

\* Figures are based on an air temperature of -20 F. This is an approximate 60-deg temperature difference. If air is to be taken at 0 F, the time to cool 10 deg will be approximately 45 percent greater. The last column shows minimum amount of water at 42 F to prevent freezing.

These rates of flow include no safety factor to provide for temporary reductions due to lower pressure, etc. Weights of water are per foot, so the minimum flow in a line 100-ft long must be at least 100 times the tabular value.

## Insulating the Pipe

Before Rock Cork insulation is applied, the pipe should be brushed with Zerogloss. The proper thickness of the insulation, according to the type of service, should then be applied to all the straight sections of the pipe line.

When the pipe is joined with flanged fittings, sections or segments should be applied about 1" away



*Rock Cork provides an economical and durable cold pipe insulation with a high resistance to moisture infiltration*

from the flange to permit thorough packing of Zero-tex between and around the bolts.

When screwed fittings have been used, the insulation should be butted tightly against the fitting. On some fittings, such as ells and tees, in certain sizes of pipe, the butting edges of the insulation may require beveling to secure correct application of the sections. A small space should be allowed between these edges so that the Zerotex may be tied in place on the fitting. Insulation applied in this manner reduces to a minimum the amount of time and material necessary to insulate fittings.

## Sectional Pipe Insulation:

Before each section of insulation is applied, both longitudinal joints and one of the end joints, should be coated with J-M Zeroseal. Then the section should be placed upon the pipe, closed and temporarily secured with from four to eight staples furnished for the purpose, the coated end being butted tightly against the uncoated end of the previously applied section. The sections should be so placed that longitudinal joints occur at top and bottom of the pipe.

The area to be covered by the waterproof lap should then be coated with Zeroseal and the lap pressed smoothly into it. The end joint should next be sealed with one wrap of sealing tape (Zerotape) bedded in a coat of Zeroseal.

The section should be permanently secured in place with six loops of copper-covered annealed steel wire or four 1/2" x 0.015" galvanized steel straps. The smaller sizes of insulation should be secured with three straps or with five loops of wire. Larger



sizes need a sufficient number to insure a tight, permanent installation. If wire is used, it should be twisted tightly and the ends neatly clipped.

#### *Segmental Pipe Insulation:*

When the insulation is furnished in segmental form, each segment is provided with a factory-applied jacket the lap of which extends along one longitudinal edge. When applied, this lap should cover the flush-cut edge of the jacket on the following segment. One longitudinal joint of each segment should be coated with Zeroseal and applied to the uncoated joint of the adjoining segment. When the complete set of segments is assembled on the pipe each area to be covered by a waterproof lap should be coated with Zeroseal and the lap pressed into it. The set is then strapped or wired in place with from three to six straps or loops of wire in the same manner as the sectional insulation.

#### *Lagging over Pipe Insulation:*

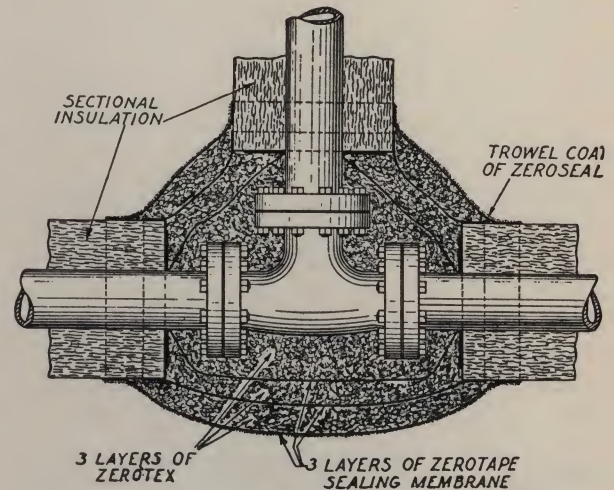
When lagging is required over the insulation, a coat of Zeroseal should be applied and the lags embedded in it. They should then be secured with from three to six straps or loops of copper-annealed steel wire, the ends of wire being neatly clipped and bent down. See "Finishes" for final asbestos felt wrapping.

### **Insulating the Fittings**

Before any fitting insulation is applied, care should be taken to see that the ends of the pipe insulation are coated with Zeroseal. The fitting should then be given a brush coat of Zerogloss.

All fittings are insulated with J-M Zerotex. Depending upon service requirements, from one to three built-up layers should be applied, each layer consisting of a

sufficient number of plies to attain a compressed thickness of from 1½" to 2". As each ply is put on, it should be secured in place with several wraps of jute twine and the built-up layer covered with a double wrap of Zerotape. Before the application of each successive built-up layer, Zeroseal should be brushed into the Zerotape to close all pores and to facilitate the application of the next layer of Zerotex.



*Fitting insulated for Heavy Brine thickness*

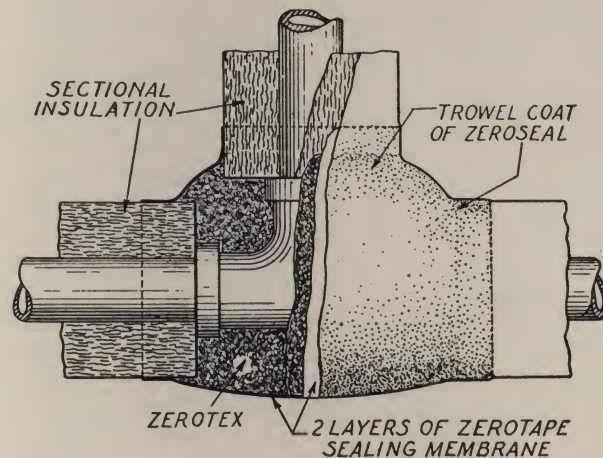
For Ice Water thickness, one layer of Zerotex, of slightly greater thickness than the pipe insulation, is required. The outer ply of Zerotex should be extended over the pipe insulation jacket about 1".

Brine thickness requires two layers of Zerotex, the first of which should be built up to about one-half the thickness of the adjoining pipe insulation. When the second layer is applied, the total thickness should be slightly greater than the pipe insulation and the outer ply of Zerotape should extend about 1" over it.

When Heavy Brine thickness is used, three layers of Zerotex are required. The first two should be applied as described for Brine thickness and the third layer applied over them. The third layer should extend about 2" over the adjacent pipe insulation.

If lagging is used over Heavy Brine thickness fittings should be insulated as described for Heavy Brine thickness, so that the total thickness of the fitting insulation exceeds that of the pipe insulation by at least 2".

Each built-up layer of Zerotex should be evenly and symmetrically packed around the fitting and care exercised to see that flanges receive the full thickness.



*Fitting insulated for Ice Water thickness*



The sealing membrane covering each layer of Zerotex should consist of a wrap of Zerotape applied so that a double thickness of the tape covers the Zerotex at every point. Over each sealing membrane, Zeroseal should be applied, leaving no uncoated spots.

The ends of the Zerotape in each case should be sealed to the pipe insulation with Zeroseal.

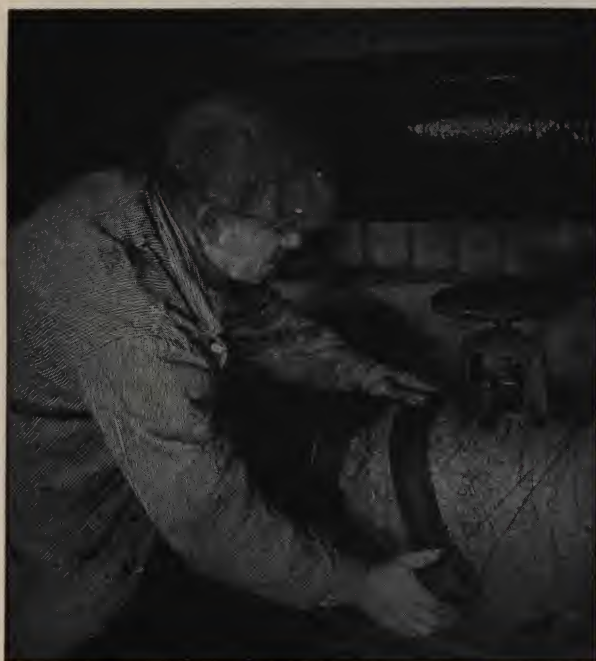
For insulating small fittings,  $1\frac{1}{4}$ " and less,  $1\frac{1}{2}$ "-wide Zerotape should be used. In these sizes, the  $1\frac{1}{2}$ " tape handles better and less tape is wasted.

After the full thickness of the Zerotex has been applied and sealed, the entire surface of the fitting should be covered with a trowel coat of Zeroseal.

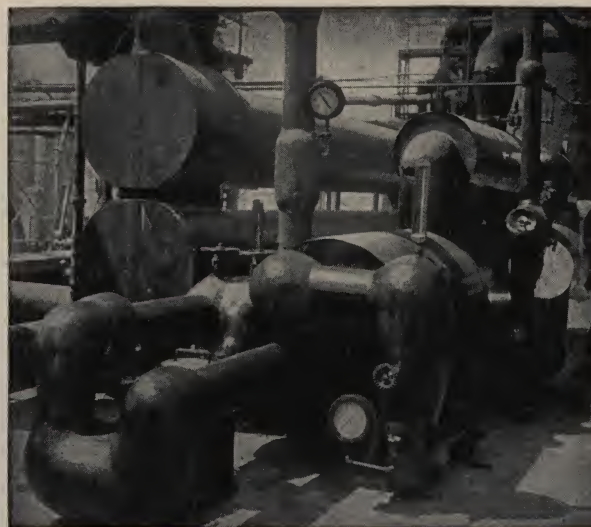
### Finishes

For a bright, black finish, a brush coat of J-M Zerogloss is recommended over all pipe insulation and fittings. If an aluminum finish is desired, ready-mixed aluminum paint of the Flintkote Company is recommended.

When lags are applied over the pipe insulation, their outside surface should be coated with J-M Zero-



*Applying the sealing membrane over Zerotex*



*The finished Rock Cork job, perfectly sealed to prevent frosting, offers a neat and workmanlike appearance*

seal, and the line then wrapped with J-M No. 50 Waterproofing Felt. Where hot asphalt can be used economically, it should be used, instead of Zeroseal, to hot-mop the felt in place. The entire line is then finished with a brush coat of Zerogloss.

For weatherproofing, insulation on all outdoor lines should be further protected with an additional jacket of J-M Double Coated Flexstone which is furnished in rolls of 108 sq ft, 36" wide, and weighing approximately 50 lb. All joints should be lapped at least 3" and sealed down with Zeroseal. All horizontal laps should be located on the side of the pipe with the laps turned downward in order to shed water from the surface. The jackets should be secured in place by means of rings of No. 16 B. & S. gauge Copperweld wire applied at not greater than 4" centers.

If fire hazard must be considered, a J-M Asbestos Firetard Jacket may be applied in the same manner as the Double Coated Flexstone. Furnished in rolls of 108 sq ft, 32" wide, and weighing about 55 lb.

Zerotex Fitting Insulation, properly sealed and coated in accord with the application directions, should receive two coats of Zerogloss or two coats of an approved aluminum paint when the line is exposed to the weather.



# J-M Built-up Brine and Ammonia Insulation

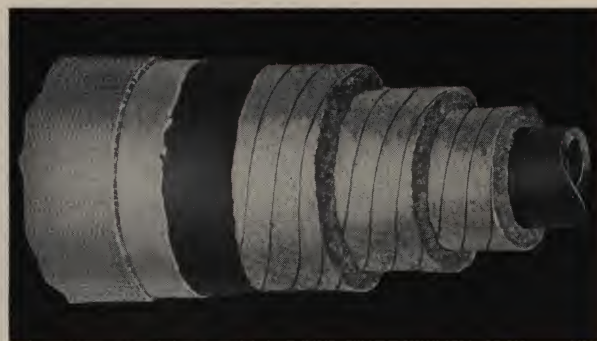
J-M Built-up Brine and Ammonia Insulating is efficient in maintaining the extremely low temperatures required in pipe lines conveying brine, ammonia or other cold liquids or gases. It consists of several layers of insulating felts carefully applied and sealed around pipes to be insulated.

The effective method of sealing eliminates the possibility of moisture accumulating between pipe and insulation and then freezing and bursting the insulation.

J-M Built-up Brine and Ammonia Insulation is not only highly efficient as an insulator, but will withstand contraction and expansion without cracking or breaking open.

This type of built-up insulation to be satisfactory should be applied only by mechanics specially trained in low temperature work. Johns-Manville Approved Contractors are experienced in applying these materials.

Insulation should be of a suitable thickness, based on temperatures contained in piping or apparatus.



The ordinary range of temperatures requires the following thicknesses:

- Plus 30°F. to plus 15°F. — 2" insulation
- Plus 15°F. to minus 5°F. — 3" insulation
- Minus 5°F. to minus 20°F. — 4" insulation
- Minus 20°F. to minus 40°F. — 5"\* insulation
- Minus 40°F. to minus 60°F. — 6"\* insulation

\*For pipes smaller than 3½" at temperatures from minus 20 to minus 60 deg. F., deduct 1" insulation.

Where temperatures are below minus 60 deg. F., recommendations will be furnished by Johns-Manville.

## Rates of Heat Transmission

The rates of heat transmission given below are expressed in B.t.u. per square foot (and also per linear foot) of pipe surface per hour, per degree temperature difference between fluid in the pipe and air surrounding the pipe. The thickness of 2-layer has been taken as 2", of 3-layer as 3" and 4-layer as 4". Sometimes the thicknesses after application are less than these nominal thicknesses and for such cases the figures in the table should be modified accordingly.

Pipe size, inches	2" Insulation		3" Insulation		4" Insulation		5" Insulation		6" Insulation	
	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.
½	.086	.390	.074	.331	.065	.295	.....	.....	.....	.....
¾	.095	.345	.079	.288	.070	.255	.069	.252	.....	.....
1	.107	.310	.088	.257	.078	.227	.072	.210	.....	.....
1¼	.124	.285	.102	.235	.090	.206	.080	.183	.....	.....
1½	.132	.265	.109	.218	.095	.190	.085	.170	.078	.157
2	.149	.240	.120	.193	.104	.167	.094	.151	.086	.139
2½	.167	.222	.133	.177	.114	.151	.107	.141	.095	.126
3	.192	.210	.148	.162	.128	.140	.114	.125	.104	.114
3½	.211	.201	.165	.157	.138	.132	.124	.119	.112	.107
4	.228	.194	.176	.150	.148	.126	.132	.112	.120	.101
4½	.247	.188	.190	.145	.158	.121	.142	.108	.127	.097
5	.268	.184	.205	.141	.170	.117	.151	.103	.135	.092
6	.307	.177	.233	.134	.191	.111	.164	.097	.149	.087
7	.343	.172	.257	.129	.212	.106	.184	.092	.164	.082
8	.380	.168	.282	.125	.232	.102	.200	.089	.178	.079
9	.415	.165	.307	.122	.242	.099	.220	.087	.191	.076
10	.455	.162	.335	.119	.279	.097	.234	.083	.206	.073
12	.528	.158	.387	.116	.310	.093	.268	.080	.234	.070



## Built-up Brine and Ammonia Insulation Specification

All pipe lines, including fittings and flanges and other apparatus containing brine or ammonia, or other cold liquids or gases, shall be insulated with Johns-Manville Built-up Brine and Ammonia Insulation of thickness indicated in preceding table.

All piping and other surfaces to be insulated shall be so located that there will be uninterrupted clearance around the finished insulation of at least 3" in all directions. The insulated piping should not be located closely adjacent to any heated surface nor located in the same chase or shaft with heated pipes.

### Materials:

Hair Felt insulation shall be 100% pure cattle hair, lime-washed and free of foreign matter, weighing not less than 11 oz. per sq. ft., 1" thick.

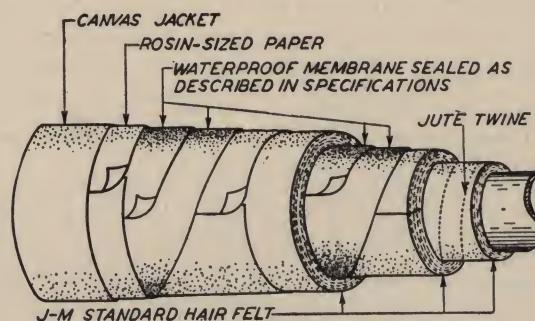
Waterproof membrane shall consist of J-M Brine and Ammonia Sealing Tape,\* wound on spirally so that at no point is there less than two plies, and covered with two coats of J-M Brine and Ammonia Sealing Compound.\*\* No uncoated spots shall be left.

### Pipes:

All surfaces shall be thoroughly cleaned and dried before insulation is applied and the system shall not be put in operation until work is completed.

Whenever it is desired to seal the end of the insulation, as at fittings, valves, flanges, etc., the bare pipe for a distance of about 1 linear foot is wrapped with the waterproof membrane, applied as described under "Materials." All pipes shall then be wrapped with a layer of 1" Hair Felt, cut to proper length, so that all longitudinal and abutting joints shall fit closely together. The Hair Felt shall be secured to the pipe by 2-ply wrapping twine, wound spirally on approximate 1" centers. Then additional layers of 1" Hair Felt shall be applied, to the thickness specified, with all joints broken.

Two-inch insulation shall have a waterproof membrane applied on the outer surface as described under "Materials." Three, four and five-inch insulation shall have two membranes, one over each of the two outer layers. Insulation thicker than 5" shall have three membranes covering the last three layers of felt.



### Fittings:

Wherever the pipe is interrupted by fittings, etc., insulation shall be sealed off by carrying membranes down to the pipe and sealing thereto.

All fittings shall be insulated separately from the adjacent piping, the insulation being of the same thickness, and applied and sealed in the same manner, as on the pipe.

Where pipe and fitting insulation meet there shall be a full thickness of insulation, and membranes of fitting insulation shall be well sealed to the outer membrane of pipe insulation.

### Hangers:

Each hanger shall be insulated separately, the same as the fittings, running the insulation along the rod of the hanger for not less than 12" beyond the adjacent pipe insulation.

### Accumulators, Tanks, etc.:

Surfaces of accumulators, tanks, etc., shall be insulated as specified above for pipe lines, except that *extra thicknesses* of insulation felts may be required on account of lower temperatures.

### Finish of Insulation:

All insulation exposed to view shall be finished with 8-oz. canvas, sewed on over a layer of rosin-sized sheathing paper, then thoroughly sized, and painted with not less than two coats of a first quality lead and oil paint, of color selected by purchaser.

All of the above insulation shall be applied by the manufacturer of the materials used, or the manufacturer's technical service unit.

\*A waterproof fabric furnished in 40-ft. rolls from 1½" to 6" wide in ½" increments.

\*\*A liquid asphaltic compound furnished in 1, 3, 5, 30 and 50-gal. containers.



## Zerolite Pipe Insulation

Zerolite® Pipe Insulation, in combination with Zero-tex® Built-up Fitting Insulation, provides the properties essential to an economical and permanent cold pipe insulation. The outstanding qualities of Zerolite are fire resistance, low heat conductivity, excellent moisture resistance, and immunity from attack and damage by many solvents.

Because of these advantages, Zerolite is particularly recommended for locations where the fire problem is dominant; where solvent fumes are encountered; and where low-heat conductivity is essential. Zerolite pipe insulation is used for such services as:

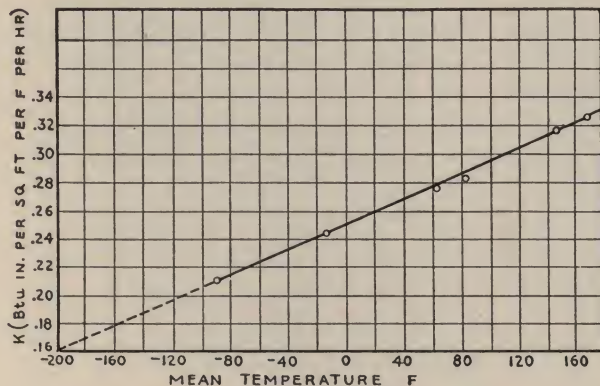
Petroleum Dewaxing Equipment	Solvent Storage Piping
Chiller and Exchanger Equipment	Ammonia and Brine Lines
Chemical Process Lines	Cold Water Lines
Pharmaceutical Process Equipment	Freon Lines

### Description

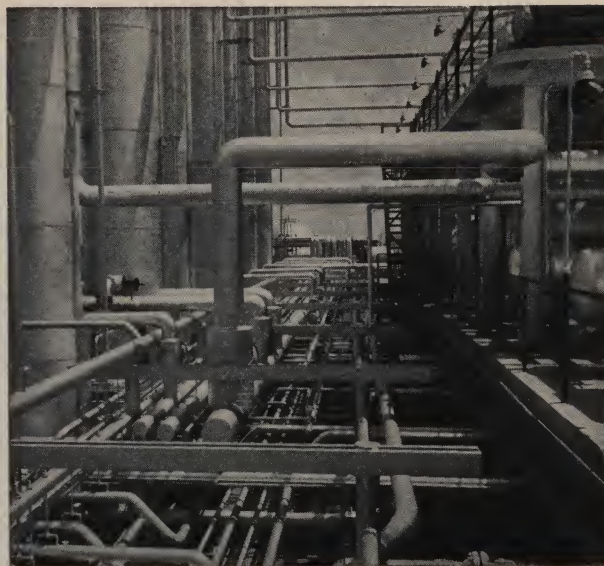
Zerolite is made from mineral wool and a resin binder, processed in such a manner as to provide maximum resistance to moisture. Each section of insulation is furnished with an integral waterproof jacket.

The insulation is furnished in single layer sections, 3-ft long, to fit standard pipe sizes. Zerolite Lagging, used as an outer application over the sectional insulation for very low temperature work, is supplied 1½-ft and 3-ft long depending upon pipe size and thickness of the lagging. It is furnished 1½", 2", 3" and 4" thick. Lagging is also used on very large pipe, small tanks and cylinders.

On special order the insulation can be supplied to fit straight runs of ¼" to 6" brass and copper tubing. Outside diameter of tubing must be stated in the order.



Zerolite Thermal Conductivity Chart



A definite thickness of insulation is supplied for each size of pipe according to the individual service requirements, as indicated. For certain pipe sizes, the insulation is furnished in sectional form, hinged; other sizes in two separate half sections (see table following).

When other conditions prevail, recommendations should be secured from Johns-Manville.

### Service Recommendations:

**Ice Water thickness** is used for water, liquid ammonia and other cold lines between 30 and 45 F.

**Brine thickness** is used for pipes conveying brine, ammonia and other cold lines between 0 to 30 F.

**Heavy Brine thickness** is used for pipes conveying brine, ammonia or other refrigerants operating at temperatures from 0 to -30 F.

The varying thicknesses for different pipe sizes are shown in the table of "Thicknesses" following.

**Temperature below -30 F:** On pipe lines operating at temperatures below -30 F, the choice of proper thickness depends upon such a number of varying factors that recommendations should be obtained from Johns-Manville.

However, under certain conditions, the following thicknesses of Zerolite Lagging over Heavy Brine thickness have been used: From -30 to -50 F, 1½" lagging for pipe sizes 1¼" to 4" and 2" lagging for pipe sizes over 4". For service temperatures ranging from -50 to -70 F, 2" lagging for pipe sizes from 1¼" to 4" and 3" lagging for pipe sizes over 4".



**Zerotex Built-up Fitting Insulation**

All fittings are insulated with J-M Zerotex, a felted mineral wool, combined in production with a water-resistant binder. Zerotex is furnished in blankets 15" wide by 48" in length with a nominal thickness of 2". During application the thickness is reduced somewhat as the material is secured in place.

To apply the felt to a fitting, a piece, slightly larger than the circumference of the fitting, should be cut from the sheet. The Zerotex should then be placed on the fitting and secured with jute twine. One to four layers may be required depending upon the thickness desired. Additional pieces of Zerotex should be cut and stuffed into low spots in the fitting to assure the proper thickness.

Each layer of the fitting insulation is covered with a double-wrapping of Zerotape, all pores of which are closed by a brushing of Zeroseal.

Zerotex Built-up Fitting Insulation has proved its worth under service conditions for an extended period of time. It offers decided advantages over rigid or pre-cast types of fitting insulation. The material can be readily adapted to any style of fitting with complete assurance of a tight, moisture-proof installation. Since all fittings are insulated with the same material, the necessity of maintaining expensive stocks of fitting jackets is eliminated.

**Accessories**

The following J-M materials are required in the application of Zerolite Pipe Insulation:

**Zeroseal:** A fibrated solvent asphalt used to seal joints of the insulation and to close all pores in the sealing membrane of Zerotape which is applied over Zerotex on fittings. It is furnished in various sized gallon containers. One gal weighs approximately 9 to 10 lb.

**Zerotape:** A high-grade waterproof fabric used as a sealing membrane over Zerotex on fittings and over end joints on pipe insulation. It is furnished in 1½" and 3"-wide rolls, 40-ft long.

**Zerogloss:** A moisture-resistant asphaltic paint which is used to give a bright black protective finish to the entire installation, both pipe and fittings. It is furnished in various sized gallon containers.

Sufficient Zeroseal®, Zerotape® and Zerogloss®, as well as copperized staples and copper-covered annealed steel wire, are shipped with the Zerolite pipe insulation for use in applying the material. If specified, galvanized steel straps and seals will be furnished instead of the annealed steel wire.

Zerotex and accessories for insulating fittings should be ordered separately.

*Thicknesses and List prices of Zerolite Pipe Insulation per linear foot*

Nominal size, pipe inches	Actual O. D. pipe, inches	Ice Water Thickness			Brine Thickness			Heavy Brine Thickness		
		O. D. insulation, inches	Thickness of insulation, inches	List price per lin ft	O. D. insulation, inches	Thickness of insulation, inches	List price per lin ft	O. D. insulation, inches	Thickness of insulation, inches	List price per lin ft
¼	0.540	3.5	1.45	\$1.00	4.5	1.98	\$1.25	6.5	2.97	\$2.10
⅜	0.675	3.5	1.40	1.00	4.5	1.91	1.25	6.5	2.90	2.10
½	0.840	4.0	1.58	1.00	5.0	2.08	1.25	6.5	2.82	2.10
¾	1.050	4.5	1.72	1.05	5.0	1.97	1.35	7.0	2.97	2.25
1	1.315	4.5	1.59	1.20	5.5	2.09	1.55	7.5	3.09	2.60
1¼	1.666	5.0	1.67	1.25	6.5	2.42	2.00	8.0	3.16	2.90
1½	1.900	5.0	1.52	1.40	7.0	2.55	2.25	8.5	3.30	3.00
2	2.375	5.5	1.55	1.55	7.5	2.56	2.35	9.0	3.31	3.50
2½	2.875	6.0	1.56	1.65	8.0	2.56	2.70	9.5	3.31	3.85
3	3.500	6.5	1.50	1.85	9.0	2.75	3.30	10.5	3.49	4.30
3½	4.000	7.0	1.50	2.25	10.0	3.00	3.65	11.0	3.50	5.00
4	4.500	8.0	1.75	2.55	10.5	2.97	3.95	12.0	3.75	5.50
4½	5.000	8.5	1.75	2.90	11.0	3.00	4.40	12.5	3.75	6.00
5	5.563	9.0	1.72	3.50	11.5	2.99	4.80	13.5	3.97	6.75
6	6.625	10.0	1.68	4.20	13.0	3.19	5.30	14.5	3.92	7.80
7	7.625	11.5	1.93	4.80	13.5	2.93	6.20	15.5	3.93	9.00
8	8.625	12.5	1.94	5.50	15.0	3.19	6.80	17.0	4.18	10.00
9	9.625	13.5	1.93	6.30	15.5	2.93	7.90	18.0	4.18	11.00
10	10.750	14.5	1.87	7.00	17.0	3.12	9.00	19.0	4.12	12.00
12	12.750	16.5	1.87	8.00	19.0	3.12	10.50	20.7	4.00	14.00

Sizes above horizontal rule are furnished in sectional form, hinged. Sizes below line are furnished in two separate half sections. Prices include accessories. Fitting Insulation not included.



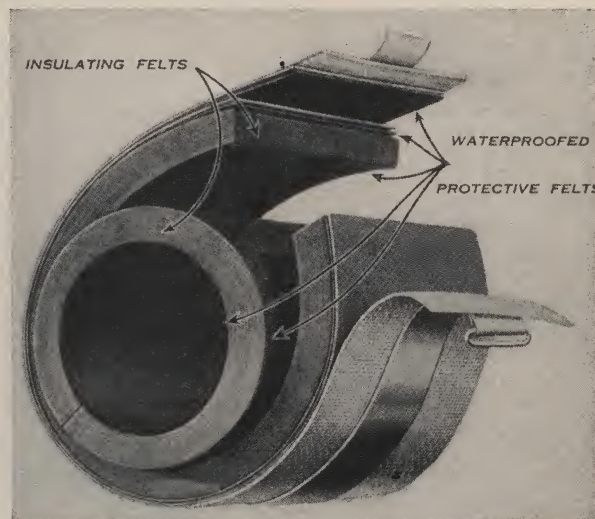
## Anti-Sweat Pipe Insulation

J-M Anti-Sweat is a cold water pipe insulation used not only to keep the water cold but to prevent condensation and damage from dripping. The insulation has particular application in such locations as weave rooms of textile mills, pickle rooms of packing plants, various locations in paper mills and in other places where sweating pipes would present difficulties and the ever-present possibility of serious water damage. J-M Anti-Sweat, a strong, resilient and durable product is the logical material for use where the insulation may be exposed to impact or shock.

Anti-Sweat is made of pre-shrunk insulating felts and waterproofing felts. The waterproofing felts, on the inner and outer surfaces of each layer, protect the insulation from the infiltration of moisture. The broken-joint construction, furnished in thicknesses of 1" and over, eliminates through joints. When this construction is applied, the outer layer is turned and slipped along so that all joints are staggered.

This material, in proper thickness, is suitable for the entire range of temperatures encountered in cold and ice water service. The required thickness depends upon temperature and humidity of surrounding air in relation to the temperature of the pipe. On pipes with temperatures over 50F, 1" of insulation is used if relative humidity is less than 75 percent; if humidity ranges from 75 to 80 percent, the 1½" thickness is used. For temperatures between 40 and 50F, if relative humidity is under 75 percent, the 1½" thickness is used. Recommendations for other conditions can be secured from Johns-Manville.

The longitudinal laps of Anti-Sweat are sealed with Laptite, applied directly over the cut, using just



enough to prevent the cement from squeezing out. As with all cold insulation installations, careful sealing

### Carton Contents and Approx. Gross Weights\*

Nominal Pipe Size, inches	¾" Thickness		1" Thickness	
	Linear Feet	Gross Wt. lb	Linear Feet	Gross Wt. lb
½	90	84	60	85
¾	75	70	54	83
1	69	77	48	79
1¼	57	73	42	81
1½	48	70	36	75
2	45	73	36	85
2½	36	72	30	80
3	27	60	21	67
4	18	50	18	70
4½	18	55	15	62
5	15	52	12	56
6	12	54	12	65
8	6	30	6	42
10	6	36	6	48

\* For popular sizes.

### Rates of Heat Transmission

Btu per hour, per degree temperature difference, per linear foot and per square foot of pipe surface

Insulation  Pipe Size, inches	½" thick		¾" thick		1" thick		1½" thick		2" thick	
	Btu per lin ft	Btu per sq ft	Btu per lin ft	Btu per sq ft	Btu per lin ft	Btu per sq ft	Btu per lin ft	Btu per sq ft	Btu per lin ft	Btu per sq ft
½	0.212	0.963	0.185	0.841	0.167	0.758	0.143	0.649	0.128	0.581
¾	0.245	0.891	0.212	0.770	0.189	0.687	0.160	0.581	0.142	0.515
1	0.286	0.830	0.243	0.706	0.215	0.625	0.180	0.523	0.158	0.460
1¼	0.338	0.777	0.284	0.653	0.249	0.572	0.206	0.473	0.180	0.413
1½	0.374	0.751	0.312	0.627	0.272	0.546	0.223	0.448	0.194	0.389
2	0.443	0.713	0.367	0.591	0.318	0.512	0.257	0.413	0.221	0.356
2½	0.518	0.688	0.425	0.564	0.364	0.484	0.292	0.388	0.249	0.331
3	0.611	0.666	0.497	0.542	0.423	0.462	0.337	0.367	0.284	0.310
3½	0.685	0.655	0.553	0.528	0.468	0.447	0.369	0.353	0.311	0.297
4	0.757	0.643	0.611	0.518	0.515	0.437	0.404	0.343	0.338	0.287



of all joints is essential to prevent the entrance of moisture vapor into the insulation.

Fittings are insulated with J-M Standard Hair Felt, of a thickness similar to adjacent insulation. The Hair Felt is sealed with a double wrap of J-M Brine and Ammonia Sealing Tape\*\* and a coat of Laptite\*. For

\* Laptite, an asphaltic sealing compound with a covering capacity of about 74 sq ft per gal. Supplied in 5, 15, 30 and 55-gal containers.

\*\* Brine and Ammonia Sealing Tape, a waterproof fabric furnished in 40-ft rolls, 1½", 2", 3" 4", 5" and 6" wide.

mild conditions or for appearance, a ¼"-thick Asbestos Cement finish may be used instead of the fabric and compound.

Anti-Sweat is made in 3-ft sections, in thicknesses of ½" and ¾", solid construction, and in 1", 1½" and 2" thicknesses, double layer construction, to fit standard pipe sizes and straight runs of copper tubing of the following outside diameters: ⅜", ½", ⅝", ⅞", 1⅛", 1⅜", 1⅝", 1⅞", 2⅛", 2⅝", 3⅛", 3⅝", 4⅛", 5⅛" and 6⅛".

## Zero Pipe Insulation

Zero Pipe Insulation is used to prevent cold water pipes from freezing under *ordinary* conditions.

It is designed for insulating cold water pipes that are exposed to moderate rather than extremely low temperatures or where the time that the surrounding air would be below freezing point is of short duration.

Zero Pipe Insulation is constructed of layers of hair felt surrounded by several layers of wool felt, with a layer of saturated wool felt inside the hair felt to keep the hair from direct contact with the pipe.

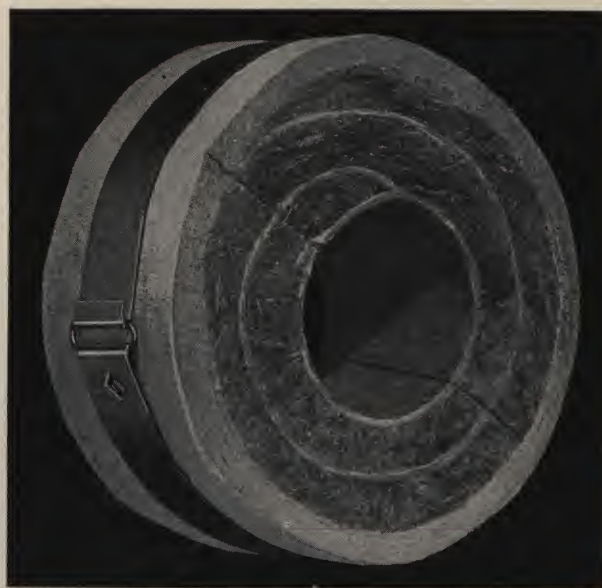
Hair felt, one of the best of insulating materials, greatly retards the flow of heat from the water in the pipe to the colder surrounding air, and the wool felt jacket and the inner layer of saturated felt provide efficient protection for the hair felt.

When this material is applied to pipes running out-of-doors, special provision should be made for a separate jacket of Double Coated Flexstone.

For extremely low temperatures or for temperatures below the freezing point that are of long duration, J-M Built-up Hairfelt is recommended, applied in various thicknesses depending upon the temperature.

Zero Pipe Insulation is furnished in 3-foot lengths, split for ready application, covered with canvas and equipped with metal bands. The insulation is made for all pipe sizes from ½" up, and in *one* thickness, approximately 1¼".

In addition to regular pipe sizes, sections of Zero are manufactured to fit straight runs of copper pipe and tubing of the following outside diameters:



⅜", ½", ⅝", ⅞", 1⅛", 1⅜", 1⅝", 1⅞", 2⅛", 2⅝", 3⅛", 3⅝", 4⅛", 5⅛" and 6⅛".

### Carton Contents and Approx. Gross Weights

Nominal Pipe Size, inches	Linear Feet per Standard Carton	Approximate Gross Weight, lb
½	60	78
¾	54	85
1	45	65
1¼	39	65
1½	36	71
2	33	76
2½	21	61
3	18	50
4	15	51



## J-M Built-up Hair Felt Pipe Insulation

J-M Built-up Hair Felt Insulation is designed to protect pipes from freezing wherever they are subjected to severe conditions. This insulation consists of a suitable number of layers of 1" J-M Standard Hair Felt securely bound in place on the pipe by means of heavy jute twine and finished on the outside with a waterproof jacket.

It is not possible to give a definite recommendation as to thickness which would suitably protect pipes under all conditions. No insulation, no matter how thick or efficient it may be, will prevent freezing where there is no circulation or only a small amount of circulation in the pipes, if the outside temperature remains low for a sufficient length of time.

Insulation will retard freezing, and if there is a certain amount of circulation or, even without circulation, if the air remains at a low temperature for a short enough period, freezing may be prevented.

To make a specific recommendation, the following information is required:

1. Minimum temperature to which pipe will be exposed.
2. Duration of this extreme temperature.
3. Temperature of fluid entering the pipe.
4. Size of pipe.
5. Length of exposed section of pipe.
6. Rate of flow through pipe.
7. Duration of periods, if any, when there will be no flow.

Following are the rates of heat transmission through 2-layer, 3-layer and 4-layer Built-up Hair Felt Insulation on pipes from 1/2" to 12" in diameter.

Also, to assist in quick estimates as to results which may be accomplished, figures are tabulated showing the length of time necessary for water in a pipe to be cooled 10 deg., from 42 to 32 F, with a difference in temperature between water and air of 60 F, which would correspond to an air temperature of about 20 F below zero.

Water should not be allowed to remain stationary for longer than one-half the time mentioned.

The last column indicates the minimum amount of water which should be supplied per hour at 42 F for each linear foot of pipe, in order to prevent the temperature of the water from being lowered to the freezing point. The weight in this column should be multiplied by the length of the pipe in feet. In order to provide against temporary reduction of flow due to lower pressure, etc., the rate of flow should

*Data on Freezing of Water in Pipes\**

Pipe size, inches	Insulation, No. of layers each 1 in. thick	Btu per deg temp. diff., per hour per lin ft	Hours to cool to freezing point	Lb water flow per hr. per lin. ft to prevent freezing
1/2	2	.0895	.417	.537
	3	.0747	.500	.448
	4	.0660	.565	.396
1	2	.1125	.825	.675
	3	.0911	1.02	.548
	4	.0798	1.16	.480
1 1/2	2	.1400	1.40	.840
	3	.1126	1.74	.676
	4	.0972	2.02	.583
2	2	.1586	1.94	.952
	3	.1244	2.48	.747
	4	.1063	2.90	.638
3	2	.2062	3.25	1.237
	3	.1572	4.27	.943
	4	.1322	5.08	.793
4	2	.2450	4.55	1.470
	3	.1850	6.02	1.110
	4	.1548	7.20	.929
5	2	.2887	5.92	1.733
	3	.2146	7.96	1.289
	4	.1764	9.69	1.059
6	2	.3302	7.35	1.981
	3	.2434	9.88	1.460
	4	.1984	12.20	1.191
8	2	.4100	10.05	2.460
	3	.2960	13.90	1.776
	4	.2390	17.25	1.434
10	2	.4930	13.00	2.960
	3	.3536	18.10	2.122
	4	.2830	22.70	1.698
12	2	.5720	15.80	3.432
	3	.4090	22.20	2.454
	4	.3222	28.10	1.933

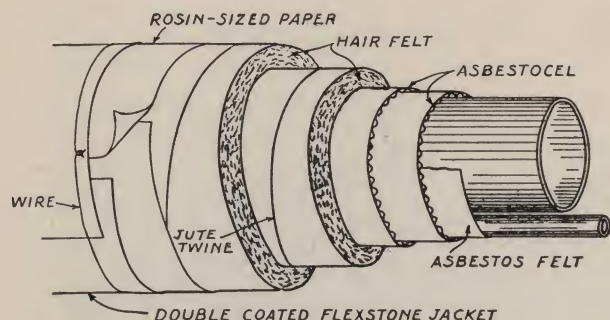
\*In the above figures, the effect of varying temperature difference due to cooling of the water has been ignored, as this is an unnecessary refinement where large factors of safety are required. The only effect of not considering this varying temperature difference is to increase the factor of safety.

The time shown in the table is the time to lower the water to the freezing point. Much longer time would be required actually to freeze all of the water in the pipes, but once it starts to freeze, the danger point has been reached. If the water were to freeze at only one point, flow would be stopped and the whole line be in danger.

be at least double that given in table. The figures on time and flow apply only to the conditions given.

If the water enters the pipe at 52 F, instead of 42 F, it will take double the time given in order to cool it to the freezing point, or only half the amount of water need be circulated.





*Insulation for standpipes with adjacent steam lines*

On the other hand, if it enters at 34 F, it will be cooled to 32 F in one-fifth of the time given or five times as much water would be required.

If the minimum temperature is about 40 F below zero (temperature difference equals 80 F), instead of 20 F, the time required to cool water to the freezing point will be 60/80 times that given in the table, or the amount of flow required will be 80/60 times that given in the table.

Where water must remain stationary longer than the safe length of time previously indicated, the only sure way of protecting the line is to provide a small steam or hot water line alongside the water line and then place insulation entirely around both lines.

### Specification to Prevent Freezing

All cold water, compressed air, soil and waste piping and fittings that are exposed to freezing temperatures, shall be insulated with J-M Built-Up Hair Felt Insulation of the required number of layers. Each layer of J-M Standard Hair Felt shall be 1" thick and secured to the pipe with a wrapping of heavy jute twine on 2" centers, and over the outer layer shall be applied a layer of 15-lb Asphalt Felt, secured in place with a wrapping of jute twine.

If no weather-proof or canvas jacket is to be applied, the Asphalt Felt at the outside of the insulation shall be sealed at both circumferential and longitudinal joints with J-M Laptite.\*

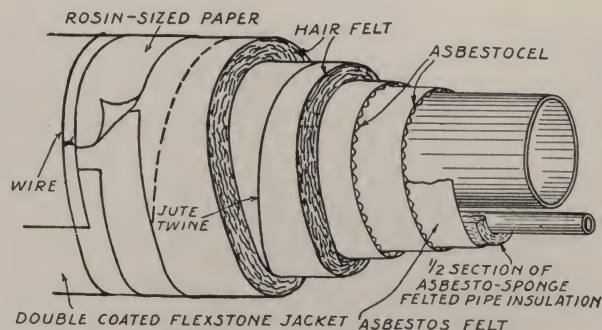
All pipe and fitting insulation exposed to view shall be enclosed in a jacket of 8-oz canvas, sewed over linings of oiled paper and of heavy rosin-sized paper. Seams shall be located where least visible.

All insulation with a canvas finish exposed to view shall be painted with first a heavy coat of glue sizing and then with two coats of first quality white lead and linseed oil paint of the desired color.

If piping is exposed to the weather, the canvas shall be omitted and in its place the insulation shall be protected by a Double Coated Flexstone Weather-proof Jacket, with all joints lapped at least 3" and sealed with Laptite.\* The jacket shall be secured with rings of No. 16 B & S gauge Copperweld wire applied on 4" centers. Laps on horizontal pipe shall be placed on the side and turned downward to shed water.

### Standpipes:

Standpipes or other water pipes in which water may not circulate for several hours shall be protected by means of a small diameter low-pressure steam line running adjacent to the water pipe. The two pipes shall then be insulated together with an inclusive covering of one layer of J-M 8-lb Asbestos Felt; two layers of 1-ply Asbestocel, in flexible roll form; and two layers of Built-up Hair Felt Insulation, each layer being secured in place with heavy jute twine. Finish over the insulation shall be provided as specified in the foregoing paragraphs.



*Insulation for hot oil lines with adjacent steam pipes*

### Hot oil lines:

Hot oil, tar lines, etc., in which it is necessary to maintain a temperature sufficiently high to insure proper flow, shall be protected from cooling by means of a small high-pressure steam pipe running adjacent to the main pipe. The two pipes shall then be insulated† as follows: A half-section of 1"-thick J-M Asbestos-Sponge Felted Pipe Insulation shall be wired over the small pipe on the side opposite to the main pipe and followed by one layer of J-M 8-lb Asbestos Felt, two layers of 1-ply Asbestocel and two layers of J-M Built-up Hair Felt Insulation, each layer being secured with heavy jute twine. Finish over the insulation shall be provided as specified above.

\* Laptite is an asphaltic cement, furnished in 5, 15, 25 or 30, and 50-gal containers. Covering capacity, approximately 74 sq ft per gal.  
† For fireproof insulation see data sheet on 85% Magnesia Pipe Insulation.



# J-M Insulating Cements

*For temperatures as noted*

Johns-Manville Insulating Cements are well known for their excellent coverage, good finish and insulating properties. There is a cement for every purpose, whether for finishing, insulating, or protective-finishing.

Asbestos insulating cements are generally used as a surface finish over block or sheet forms of insulation, to seal all joints between the blocks and to pro-

vide a smooth, attractive finish or a surface to which canvas may be applied if desired.

J-M Insulating Cements are also especially suitable for insulating irregular surfaces such as valves, flanges and other pipe fittings, heating furnaces, kettles, etc., where it would be impracticable to apply pipe insulation, sheets or blocks.

## Finishing Cements

### *No. 302 Insulating Cement (To 1000 F)*

No. 302 Cement, made of asbestos fiber and binding materials, is a high-grade finishing cement that is easy to mix and apply.

It produces a hard, durable and attractive surface which does not crack, break or peel off.

### *No. 352 Insulating Cement (To 1000 F)*

No. 352 Cement is the general utility asbestos fiber cement used in large quantities by the plumbing and

steamfitting trade for insulating heating boilers and pipe fittings.

### *No. 0352 Insulating Cement (To 1000 F)*

No. 0352 Cement is a factory-made cement suitable for many of the requirements of the plumbing and steamfitting trade.

### *No. 400 Insulating Cement (To 700 F)*

No. 400 Cement is a smooth-finishing product of good insulating value. Not quite as hard as No. 302.

## Insulating Cements

### *Superex Insulating Cement (To 1900 F)*

Superex Insulating Cement is Superex Insulation in powdered or cement form for use on irregular surfaces where the application of block or pipe insulation is impractical.

### *No. 500 Insulating Cement (To 1800 F)*

No. 500 is an expanded vermiculite base insulating cement. It has exceptionally high covering capacity, combined with good working qualities and insulating value. It has good adhesion and can be applied in thick coats to irregular surfaces on which block and sheet insulation are not adaptable.

### *No. 450 Insulating Cement (To 1500 F)*

No. 450 is a mineral wool base cement with good covering capacity and excellent adhesion to both hot and cold surfaces. It is a very good insulator compared with other cements. Its excellent adhesion permits it to be readily applied in thick layers to surfaces too irregular to insulate with sheet and block forms.

### *J-M 85% Magnesia Cement (To 600 F)*

This material is J-M 85% Magnesia Insulation in powdered or cement form. Compared with other cements, its insulating value is high. It is not ordinarily recommended as a finishing cement.

## Protective-Finishing Cements

### *No. 678 Semi-Refractory Cement (To 1900 F)*

No. 678 Cement is a combined finishing and semi-refractory cement for use as a protective coating over block insulation linings exposed to the action of moving gases in flues, breechings and stacks. Where erosive action is severe such as in pulverized coal units and particularly in areas where the gases change direction sharply, the cement should be protected with tempera-

ture-resistant metal. No. 678 is a hydraulic, air-setting cement.

### *No. 319 Semi-Refractory Cement (To 1600 F)*

No. 319 is a combined finishing and semi-refractory cement for use in setting and sealing Superex Blocks in rotary kilns, sealing Vitribestos sheets in stacks, and similar uses. No. 319 requires the immediate application of heat to obtain maximum hardness.

*For data on packaging, mixing, etc., see table on reverse.*



## Data on Johns-Manville Insulating Cements

Designation of Product	General Use of Product	Character or Base	Maximum Service Temperature, F	Covering Capacity, Applied and Dried, 1" Thick		Approx. lb of Water to mix 100 lb Cement	Packaging, lb per Bag
				Sq ft/100 lb	Sq ft/Bag		
No. 302	Finishing	Asbestos	1000	25	25	175	100
No. 352	"	"	1000	19	9½ or 19	100	50 or 100
No. 0352	"	"	1000	19	19	100	100
No. 400	"	"	700	25	25	150	100
Superex	Insulating	Diatomaceous Silica	1900	45	34	250	75
No. 500	"	Expanded Vermiculite	1800	78	39	300	50
No. 450	"	Mineral Wool	1500	50	25	250	50
85% Magnesia	"	Magnesium Carbonate	600	70	35	450	50
No. 678	Protective-Finishing	Semi-Refractory	1900	20	10	75	50
No. 319	"	"	1600	15	7½	60	50

## J-M Fibrous Adhesive

In applying sheet, block or brick insulation to flat surfaces, as well as to curved surfaces of large diameters, it is necessary, in a majority of cases, that the insulation be temporarily held in place until the application of the outer binding support and final finish.

J-M Fibrous Adhesive successfully takes the place of other temporary binding methods, being applied easily and rapidly and yet furnishing a moderately strong and effective support for the insulation until the permanent panel or finish is applied which secures the insulation in place.

Fibrous Adhesive is recommended for use where insulation is applied to brick, concrete, metal or other surfaces, and is also a satisfactory adhesive for binding insulating blocks together in multiple layer construction. To attain maximum adhesion, Fibrous Adhesive should be used at sufficiently high temperatures to dry thoroughly.

For temperatures between 250 and 500 F, Fibrous Adhesive may be used as the principal means of attachment of insulation directly to the surface of ducts, flues, etc. In such cases, however, a secondary support should always be provided, such as cables or mesh wire, tightly laced over the surface of the blocks.

Fibrous Adhesive is applied to the face of the insulating material, which is then pressed in place against the surface to be insulated. It is not necessary to coat the entire face of the insulation if only temporary support is required, as spotting of the adhesive is usually sufficient.

Only a sufficient thickness of the adhesive to obtain a thin film for bonding need be used; however, the thickness required depends largely upon the smoothness of the surface. Bare metal surfaces require less adhesive than is necessary for application of insulation to brick or concrete or to other insulation.

All paint *must* be removed before insulation can be applied by Fibrous Adhesive, or the insulation will loosen after the adhesive dries out.

In estimating requirements, the following covering capacities may be used: For adhering insulation to metal surfaces, 50 lb of Fibrous Adhesive will cover approximately 100 sq ft of surface. For adhering insulation to brick, concrete or other insulation, 75 lb of Fibrous Adhesive will cover about 100 sq ft.

Fibrous Adhesive is supplied ready for use, in 75, 175, 350 and 600-lb containers.



## J-M Insulating Fills

### Sil-O-Cel\* C-3

*For temperatures to 2000 F*

Sil-O-Cel C-3, an insulating fill, is made from the mineral Celite, calcined in order that it may withstand temperatures as high as 2000 F.

Sil-O-Cel C-3 is a coarsely ground, granular material with a sufficient proportion of fines to insure a uniform mass without large voids. It may be used alone as a granular fill material, or in combination with portland or calcium aluminate cement to form Sil-O-Cel C-3 Insulating Concrete as described on another data sheet. Sil-O-Cel C-3 will not shrink and, for a material which can be used at so high a temperature, is a remarkably efficient insulator.

Sil-O-Cel C-3 is used for insulating tops and for filling walls of heated equipment operating at extremely high temperatures or in equipment where lack of space prohibits the use of any but relatively thin fire brick linings and where the insulation is therefore subjected to very high temperatures. A typical application of this material in dry form is in the bases of oil-fired marine boilers.

Sil-O-Cel C-3, loose, weighs about 26 lb per cu ft. When moistened and rammed into place, without the addition of any bonding material, it weighs approximately 31 lb per cu ft. Packed in bags of 100 lb.

### Sil-O-Cel Insulating Powder

*For temperatures to 1600 F*

Sil-O-Cel Insulating Powder is manufactured from the pure mineral Celite, milled to a high degree of fineness. Milling is very carefully done in specially designed equipment to preserve the natural cellular structure of the material. Sil-O-Cel Powder is furnished in bags of 50 lb.

This material has an exceptionally high insulating value. It can be used where it will be subjected to temperatures as high as 1600 F. When loosely poured, Sil-O-Cel Insulating Powder weighs about 10 lb per cu ft and, when packed in place to the proper density (15 to 17 lb per cu ft), it will retain its effectiveness indefinitely.

The high insulating efficiency of Sil-O-Cel Insulating

\* Reg. U. S. Pat. Off.



*Installing Sil-O-Cel Coarse Grade in wall of a tunnel kiln.  
Sil-O-Cel Coarse Grade is also used on the top*

Powder makes it ideally adapted for use where structural strength and rigidity are not required of the insulation. When used to cover the tops of furnaces, tunnel kilns and similar equipment, the material should be lightly tamped to a density of about 15 lb per cu ft. Tamping is facilitated by moistening.

To prevent dusting when Sil-O-Cel Insulating Powder is used over the top of heated equipment, a lime or cement slurry is often used to form a top crust.

For packing in walls of ovens, furnaces, kilns, etc., it should be tamped to about 17 lb per cu ft.

### Sil-O-Cel Coarse Grade

*For temperatures to 1600 F*

Sil-O-Cel Coarse Grade is a material very similar to Sil-O-Cel Insulating Powder, excepting that, as the name implies, it is not milled to such fineness as the powder. It should be packed to a density of about 22 lb per cu ft. Shipped in bags of 50 lb.

Sil-O-Cel Coarse Grade is particularly adapted for



insulating the walls of such equipment as lime kilns, vertical boilers, etc. Because of its coarser nature, it is easier to pack than Sil-O-Cel Insulating Powder.

### **Fil-Insul**

*For temperatures to 1000 F*

Fil-Insul is used as an insulating fill in irregular spaces where insulation in block or brick form is not practicable and where a resilient high-grade fill is needed. It will permit considerable expansion and contraction because of its fibrous nature which also serves to prevent any settling or sifting through cracks. Weighs about 15 lb per cu ft packed to the proper density. Furnished in 65-lb bags.

### **Fibrocel\***

*For temperatures to 1800 F*

Fibrocel is a mixture of diatomaceous silica and long fiber asbestos. Due to the asbestos fiber, this material has certain characteristics different from the ordinary powdered fills. The fibers offset any tendency to settle or filter through cracks, which makes the material well adapted for use as a fill on gas generator sets, etc. Approximate weight, 18 lb per cu ft when packed in place to the proper density. Furnished in 80-lb paper bags.

### **Granulated Rock Cork\***

*For temperatures below 100 F*

Granulated Rock Cork, a mineral wool product treated with a bituminous binder, is used where a loose, moisture-resisting fill, which can be poured into place, is required for low-temperature service. It weighs 12 to 14 lb per cu ft, packed to the proper density. Unless otherwise specified, furnished in 40-lb paper bags.

### **Zerofil\***

Zerofil is an asphalt-impregnated loose mineral wool (not granulated), designed for use as a low-temperature insulation where a hand-packed type of insulation must be used to fill irregular spaces. It is highly resistant to moisture. Zerofil weighs about 7 lb per cu ft and should be packed to a density of about 10 lb per cu ft. Unless otherwise specified, furnished in paper bags containing 40 lb.

\* Reg. U. S. Pat. Off.



*Banroc Loose, pulled apart to show its texture, has been found suitable for many uses as an insulating fill*

### **Zerotex\***

Zerotex is a felted mineral wool which is combined in production with a water-resistant binder. It is used to insulate fittings on cold pipe lines. Zerotex is furnished in blankets 15" wide by 48" in length with a nominal thickness of 2". During application the thickness is reduced somewhat as the material is secured in place. Zerotex is supplied in bags containing 100 sq ft.

### **Banroc\* (mineral wool)**

Banroc is a light-weight, effective insulating material produced from high silica minerals. Being incombustible, it is also useful as a fire retardant.

This material has been found suitable for use as an insulating fill in the hollow walls of baking ovens, fireless cookers, domestic hot water heaters and for similar purposes where a loose bulk insulation is required.

Banroc is furnished in two grades: Banroc Loose and Banroc Granulated. Shipped in paper bags containing 40 lb, unless specified otherwise.

#### ***Banroc Loose:***

Banroc Loose may be packed to various densities but usually 12 lb per cu ft is recommended.

#### ***Banroc Granulated:***

Banroc Granulated is made from regular Banroc Loose and is used primarily for hand-packing and pouring. It may be placed at various densities, but when the material is loosely poured into position, 9 to 10 lb per cu ft is recommended; when hand packed, 10 to 12 lb per cu ft.



# Sil-O-Cel C-3' Insulating Concrete

*For temperatures to 1800 F*



*The efficient performance of these large janning ovens is assured through the use of Sil-O-Cel C-3 Concrete with 9" thick walls and tops. Size of ovens 9 ft. wide, 22-ft high, 50-ft long*



*Battery of four monolithic gas-fired core ovens, constructed throughout of Sil-O-Cel C-3 Concrete with 12" thick walls and tops. The doors were built of Sil-O-Cel C-3 Concrete 9" thick*

Sil-O-Cel C-3 in the form of insulating concrete, can be cast into any shape desired. This has made it possible to utilize insulation where previously it had been impossible to do so for structural reasons. Sil-O-Cel C-3 can be easily cast in monolithic form for the construction of doors, baffles, dampers, etc., and, when suitably reinforced, may be moulded into large units for such purposes.

Sil-O-Cel C-3 Insulating Concrete is made by mixing four parts of Sil-O-Cel C-3 and one part of portland or lumnite cement, by *volume*, with sufficient water to form a plastic, coherent mass. Care should be taken to avoid excess water. For this purpose approximately 28 lb of Sil-O-Cel C-3 are required per cu ft, when rammed into place and dried.

Sil-O-Cel C-3 Concrete can be applied very satisfactorily to steel surfaces, such as stacks, by means of a cement gun. It can also be applied with a cement gun to the brick walls of existing equipment, such as open-hearth regenerators.

Sil-O-Cel C-3 Concrete is over three times as effective as fire brick in preventing heat penetration. Made in accordance with specifications, the material sets up into a strong, durable concrete weighing approximately 60 lb per cu ft and with a crushing strength of about 1,000 lb per sq in. (72 tons per sq ft). It has a high degree of refractoriness for an insulating

material and can be used without other refractory protection where it may be subjected to direct heat as high as 1800 F.

Suitable reinforcing, such as would be used in ordinary concrete, and provision for expansion joints are important in the case of Sil-O-Cel C-3 Concrete as with any other monolithic material.

## *For monolithic construction of ovens, etc.:*

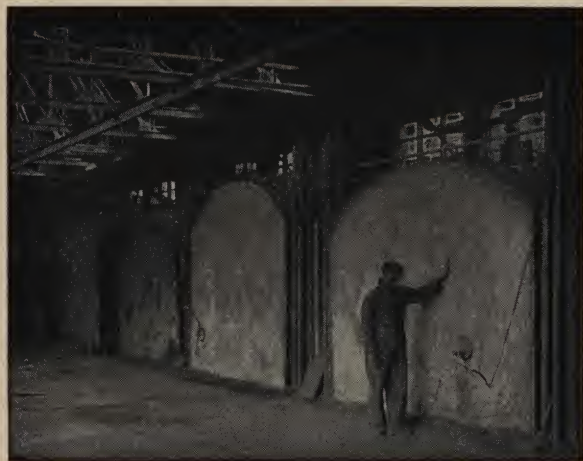
Such equipment as janning and enameling ovens, core ovens, etc., where the heating operation is carried on at a comparatively low temperature, are in many cases now being constructed entirely of Sil-O-Cel C-3 Concrete.

Ovens of this type can be constructed and operated at very great savings over the ordinary type of masonry construction. Due to the insulating properties of Sil-O-Cel C-3 Concrete and the fact that all masonry joints are eliminated, fuel consumption is surprisingly low. This construction can be satisfactorily employed for many types of equipment.

## *For foundation and bases:*

Sil-O-Cel C-3 Concrete is an ideal material for insulating the bases of heated equipment. In fact, the practice of insulating bases can be said to have originated with the introduction of this material. It is used for base insulation in various types of heat-





*Sil-O-Cel C-3 Concrete is ideally adapted to the construction of monolithic furnace doors. The C-3 Concrete doors on this battery of malleable annealing ovens are 9" thick*

treating furnaces, kilns, oil still furnaces, hot blast stoves, open-hearth furnace regenerators and flues, and in many other types of high temperature equipment where heat transmission through the base would otherwise amount to a considerable loss.

Insulation of the bases of such equipment is now recognized as being essential, not only because of the fuel saving, but also because it insures more uniform heat distribution within the equipment and protects the foundations from excessive heat.

#### *Sil-O-Cel C-3 Concrete doors:*

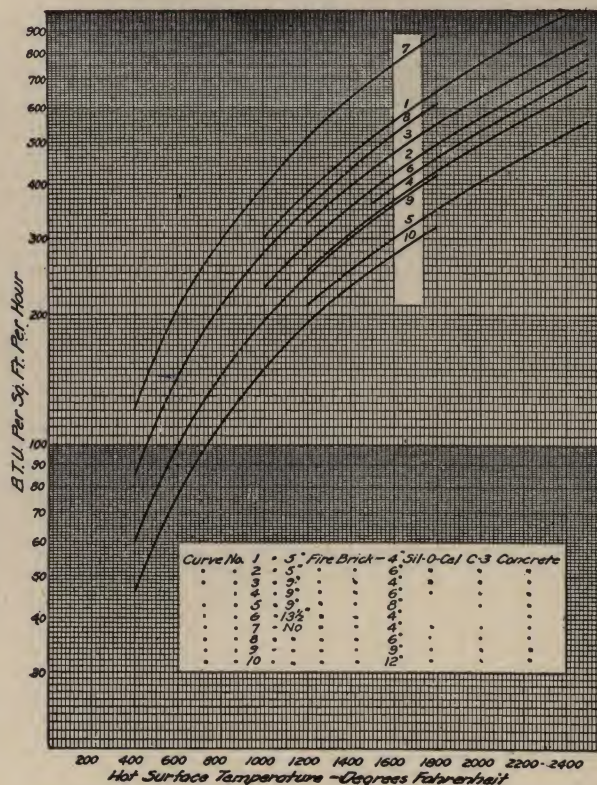
Sil-O-Cel C-3 Concrete is the principal material in use today for furnace door construction. Fire brick doors, as formerly used, are highly conductive of heat. Such heat waste is costly, reduces the output of the furnace, disturbs temperature uniformity, makes close control impossible, and causes unsatisfactory conditions for the operators. Since fire brick weigh about 130 lb per cu ft, fire brick doors also have the disadvantage of great weight, which makes them hard to handle, and elaborate counter-balancing devices are often required. Sil-O-Cel C-3 Concrete weighs less than half as much as fire brick, conducts less than one-third as much heat and costs less per door installed.

On doors where the temperature is too high for Sil-O-Cel C-3 Concrete or where there is trouble due to erosion or abrasion, a protective facing\* of Firecrete Refractory Cement, 1½" thick, is very effective. The C-3 Concrete is tamped into the door frame

to a level approximately 1½" below that desired for the finished lining. While the concrete is still fresh, ½" of Firecrete is applied and rodded sufficiently to obtain a mixing of the Firecrete and C-3 for a depth of an inch or more below the surface of the mixture. Immediately thereafter, before the concrete has set, an additional 1" of Firecrete is applied without rodding, and troweled to a smooth finish level with the inside of the door.

#### *Other uses:*

Sil-O-Cel C-3 Concrete is an excellent material for making up special shapes such as baffles, dampers, etc. It is also cast into covers for wheel annealing pits; used as an insulating lining for hot metal cars in steel mills; for the construction of fire screens to protect workmen operating in front of open furnace doors; and for a great variety of other uses. In many cases Sil-O-Cel C-3 Concrete is particularly adapted for insulating on the outside of walls of equipment previously constructed without insulation. Application is effected through the use of wood or sheet metal forms or by means of a cement gun.



*Heat losses through Sil-O-Cel C-3 Concrete, with and without fire brick linings*

\*U. S. Patent No. 2,042,870.



# Insulkote

For temperatures to 250 F

Insulkote® is a durable, easily applied, coating for the protection of insulated surfaces against weather or water vapor. Insulkote is furnished in several grades or types to meet various application specifications.

All of the Insulkotes are compounded of selected and processed bitumens, asbestos fiber and mineral fillers. These formulations were chosen after careful development and testing to give maximum protection at lowest applied cost to insulated tanks, breechings, piping and other process equipment.

Years of service in the field demonstrate that Insulkote resists acid or alkaline atmospheres and will stand up under the most adverse weather conditions. Its composition minimizes surface cracking and crazing under sudden temperature changes.

When insulation is water-saturated it loses its insulating value because of the relatively high thermal conductivity of water. Water also contributes to the rusting of metal surfaces. . . . Insulkote effectively seals out water to preserve maximum insulation efficiency and helps prevent rusting and corrosion of expensive equipment.

Some service conditions, notably those in which high temperatures prevail, require a coating that keeps out water but will permit the passage of water vapor. . . . There is an Insulkote designed for each condition.

## Types of Insulkote

Insulkote is furnished ready-mixed in two consistencies to facilitate quick, easy trowel or spray application. A jet-black material, it will not fade after application;



Troweling Insulkote ET protective coating over wire mesh

future patches will not contrast with the weathered coating. . . . If desired, Insulkote may be painted by applying a sealing coat of aluminum paint or equivalent, followed by a finish coat of lead and oil paint.

The letter designations used for the different Insulkotes (following) are: E=emulsion type; S=solvent type; T=trowel consistency; G=spray-gun consistency; and C=cork filler.

Properties: The following table summarizes the physical characteristics of the six types of Insulkote.

Physical Properties

Properties	Types of Insulkote					
	ET (emulsion)	EG (emulsion)	ST (solvent)	SG (solvent)	EGC (emulsion)	SGC (solvent)
Application	Trowel	Gun*	Trowel	Gun*	Trowel or Gun*	Trowel or Gun*
Wt per gal, lb	10	10	9.5	9.5	7.5	7
Coverage (1/4" thick), Per 100 sq ft, gal	16	16	8	8	16	16
Shrinkage, Volumetric, percent	50	50	25	25	40	20
Water Vapor, For recommended thickness, perms	0.2-0.5	0.4-0.7	0.0-0.1	0.1-0.2	—	—
Temperature Use, Range, F	100-250	100-250	to 250	to 250	100-250	to 250

\* Spray-gun application involves some loss through bounce and "over spray." Loss varies with air velocities and types of surfaces.

NOTE: All solvents have some degree of toxicity. Therefore proper ventilation should be provided where material is used in closed spaces.



**Insulkote ET and EG:** Non-burning, weather-resistant coatings for use over insulation on heated vessels, tanks, related equipment and other insulated surfaces where "breathing" coatings are required. Insulkote ET is for troweling and EG for spray-gun application.

**Insulkote ST and SG:** These Insulkotes are weather-resistant and vapor barrier coatings for insulations on refrigerated vessels, tanks, piping and related equipment. Insulkote SG is an excellent anti-corrosion coating. For special conditions, both ST and SG can be sup-

plied with non-flammable solvents. Insulkote ST is used for troweling and SG for spray-gun application.

**Insulkote SGC and EGC:** Combination Insulkotes for protection against weather and corrosive atmospheric conditions. They will also prevent condensation under moderate conditions. Both SGC and EGC may be applied by trowel or spray gun.

**Insulkote Primers:** Two primers are furnished—Primer E for use with Insulkotes of the emulsion type, and Primer S for use with the solvent type Insulkotes.

## Application

**General:** When Insulkote is applied over asbestos cements such as J-M No.352 (or No.302) mixed with portland cement and underlaid with wire-mesh reinforcement no priming coat is required. However, if the material is applied over non-absorptive surfaces such as steel, mineral-fiber insulations, or dried Insulkote, a priming coat of Insulkote Primer should be applied.

For best results, the Insulkote Primer should be applied while it is still sticky. If the primer dries out before the Insulkote is applied a vapor-proof seal will result, defeating the purpose of the primer.

It is recommended that the Insulkote be applied after the equipment has reached its approximate operating temperature. Insulkote should be applied as received; no additional treatment is necessary. Follow container directions for Insulkote Primer.

**Wire-Mesh Reinforcement:** Wire-mesh reinforcement is applied as follows:

Stretch a reinforcing 2" (max) x No.20 gage hexagonal wire mesh over the insulation. All joints in this mesh should be lapped two mesh widths and securely tied (not laced) with No.16 gage wire ties on not greater than 8" centers. Additionally secure the mesh with No.16 gage tie wires, previously secured to the insulation tie points. After twisting, the ends of these tie wires should be left for securement of another mesh to follow.

**Application of Cement over Wire-Mesh:** Apply a ¼" thick coat of J-M No.352 (or No.302) Asbestos Cement mixed two parts by weight with one part of portland cement. The asbestos and portland cements should first be mixed dry and then mixed with clean water, added gradually. Sufficient water to assure a good bond with the insulation should be used. A skim coat of cement should first be applied by trowelling firmly into the mesh wire and followed immediately by sufficient cement to build up

to the required ¼" thickness. The final application of cement should not be trowelled excessively. When the cement coat is dry, stretch a second reinforcing 1" x No.20 gage hexagonal wire-mesh lapped, tied and secured in the same manner as the first mesh.

**Application of Insulkote ET:** Coating should be trowelled on over wire-mesh to approximate thickness of ¼". . . . On mineral fiber insulations, Insulkote Primer E should be applied and Insulkote ET trowelled on while the primer is still tacky. Wire-mesh reinforcement is not required except where movement or vibration may occur.

**Application of Insulkote EG:** The same as for Insulkote ET except that this Insulkote is for spray-gun application. For spray gun, two equal ⅛" coats should be applied.

**Application of Insulkote ST:** This Insulkote should be trowelled on in thicknesses not greater than ⅛" to avoid slumping while there is still solvent in the coating. . . . On mineral-fiber insulations, Insulkote Primer S should be applied as a prime coating. Wire-mesh reinforcement is not required except where movement or vibration may occur.

**Application of Insulkote SG:** When applied over wire-mesh, the Insulkote is gunned on in two equal ⅛" coats. . . . Over glass-fabric reinforcement, under certain conditions, a ⅛" (approx.) coating is sprayed on the surface to be covered and the glass fabric rolled or pressed into this coating. A second coat of Insulkote SG is then sprayed on to give a total wet thickness of approximately ⅛". . . . When used as metal protection, no primer or wire reinforcement is necessary. Metal must be clean and dry at time of application. . . . When used on mineral fiber insulation, a priming coat of Insulkote S is sprayed on before application of Insulkote SG.

**Application of Insulkotes SGC or EGC:** These Insulkotes are suitable for either spray gun or trowel application. Primer Insulkote S is used with SGC and primer Insulkote E for EGC. Two equal ⅛" coats are required in spray-gun application to build up a thickness of ¼".

## Application of Aluminum Paint\*

Insulkote ET or EG shall be allowed to dry thoroughly before application.

Insulkote ST or SG shall be subjected to service conditions for about ten days before applying paint, to allow excess solvent to dry out.

Where paint is to be applied to roofing felts, it is necessary only that the surface be dry and clean.

The aluminum paint shall consist of one of the following, or equal: Ready-Mixed Aluminum Paint of the Flintkote Com-

pany; Valdura Asphalt Aluminum Paint made by the American Asphalt Paint Company, Chicago, Ill.; or Bituseal Exterior Aluminum Paint manufactured by the Cheeseman Elliot Company, Brooklyn, N. Y.

The paint shall be mixed immediately before using and in no case shall more paint be opened than can be used the same day.

The paint shall be applied in two coats, the first of which shall be allowed to stand not less than 24 hours or longer as required to dry thoroughly, before the second coat is applied.

The paint can be applied by brushing, but a spray will give a quicker, and possibly slightly smoother, job than can be obtained by means of a brush.

\* If a finish of lead and oil paint is desired, the Insulkote should be primed with aluminum paint or shellac.



## Jackets for Outdoor and Underground Pipe Insulation



*This installation of Rock Cork Pipe Insulation was photographed 4 years after application. The weatherproof jacket maintained, unimpaired, its high insulating value*

### **Specification A:**

Insulation on outdoor piping shall be protected from the weather by the methods outlined in the following paragraphs, with variations noted for Rock Cork and Zerolite.

All outdoor pipe insulation shall be finished with a weatherproof jacket of Double Coated Flexstone. All joints shall be lapped at least 3", horizontal joints lapping downward to shed water. Longitudinal laps on vertical pipe shall be sealed with Laptite. All other joints shall be left unsealed.

The jacket shall be secured with loops of No.16 AWG Copperweld wire applied on not greater than 4" centers or  $\frac{1}{2}$ "x0.015" corrosion-resistant metal bands and clips applied on not greater than 6" centers, with one loop on each end lap.

Insulation on pipe bends, fittings, flanges and valves shall be carried about 4" over the adjoining pipe and finished with a filling and smoothing coat of J-M No.352 or 302 Insulating Cement, mixed two parts by weight with one of portland cement. When dry, a  $\frac{1}{4}$ "

(wet) troweled coat of Insulkote ET weatherproofing shall be applied. On pipe sizes 4" and over, the weatherproofing shall be reinforced with 1" x No.20 W & M gage galvanized hexagonal mesh wire previously secured over the coat of cement. The jacket over adjoining pipe insulation shall lap about 4" over the Insulkote ET weatherproofing.

**Rock Cork or Zerolite Pipe Insulation:** The weatherproof jacket shall be applied over Rock Cork or Zerolite only after the pipe insulation has been vaporproofed in accordance with standard J-M recommendations.

Zerotex Fitting Insulation, properly vaporproofed in accordance with application directions, shall be finished with a  $\frac{1}{8}$ " (wet) troweled coat of Insulkote ST, feathered off to the end of the vaporproofing carried over the adjoining pipe insulation.

### **Specification B:**

Where initial cost is a primary factor, all outdoor pipe insulation, except that on low-temperature pipe, shall be protected from the weather with a jacket of



J-M Service Roofing. . . . Application shall be the same as that in Specification A.

### **Specification C:**

Where the weatherproof jacket is furnished as an integral part of the insulation, the lap on horizontal pipe shall be turned downward to shed water. On vertical pipe, the lap shall be sealed with Laptite.

Circumferential end strips of weatherproofing felt, 7" wide, as furnished with the insulation, shall be applied over each end joint. On vertical pipe, the end strip shall be sealed to the upper section and the lap sealed with Laptite. The lap of each end strip shall be placed on the opposite side of the pipe from the jacket lap and shall be turned downward on horizontal pipe to shed water.

The jacket shall be secured with loops of No.16 AWG Copperweld wire applied on not greater than 4" centers or  $\frac{1}{2}$ "x0.015" corrosion-resistant metal bands and clips applied on not greater than 6" centers, with two loops on each end strip.

Insulation on pipe bends, fittings, flanges and valves shall be carried about 4" over the adjoining pipe and finished with a filling and smoothing coat of J-M No.352 or 302 Insulating Cement, mixed two parts by weight with one of portland cement. When dry, a  $\frac{1}{4}$ " (wet) troweled coat of Insulkote ET weatherproofing shall be applied. On pipe sizes 4" and over, the weatherproofing shall be reinforced with 1" x No.20 W & M gage galvanized hexagonal mesh wire previously secured over the coat of cement. End strips shall lap about  $3\frac{1}{2}$ " over the Insulkote ET weatherproofing.

### **Specification D:**

In exceptional cases where the insulation and jacket would be subjected to mechanical injury from excessively rough usage, a suitable metal jacket shall be substituted for the weatherproof jacket specified above.

### **Specification E:**

Where fire hazard must be considered due to the fact that flame may be carried along exposed piping when fire occurs adjacent to such lines, a fire-retardant weatherproof jacket of Asbestos Firetard shall be applied. . . . Application shall be the same as that in Specification A.

### **Specification F:**

All pipe insulation in underground tunnels or conduit shall be protected from water submersion with a No.50 Asbestos Waterproofing Felt, Perforated. All joints shall be lapped about  $1\frac{1}{2}$ " and left unsealed. Longitudinal laps shall be located on top of the pipe to permit ready escape of steam after submersion.

The jacket shall be secured with loops of No.16 AWG Copperweld wire applied on not greater than 4" centers or  $\frac{1}{2}$ "x0.015" corrosion-resistant metal bands and clips applied on not greater than 6" centers, with one loop on each end lap.

Insulation on pipe bends, fittings, etc., shall be finished the same as in Specification A.

### **Pipe Insulation Jackets and Lap Cement**

**Double Coated Flexstone:** An asphalt-saturated and coated asbestos felt furnished in rolls of 108 sq ft, 36" wide, weighing approximately 50 lb per roll.

**Asbestos Firetard Jacket:** A fire-retardant weatherproof jacket consisting of one sheet of asphalt-saturated asbestos felt over which an unsaturated asbestos felt is cemented for an outer surface. This jacket will not drip asphalt, carry flame or support combustion. It is furnished in rolls of 108 sq ft, 32" wide, weighing approximately 55 lb per roll.

Any slight exfoliation or disintegration in the unsaturated felt can be arrested by an application of Sipe's Dipping White Paint mixed with an equal part of gasoline. The mixture results in a thin, white coating. The gasoline volatilizes comparatively rapidly after it is applied. Sipe's Dipping White Paint is made by J. B. Sipe and Company, Pittsburgh, Pa.

**Service Roofing:** An asphalt-saturated and coated felt furnished in rolls of 108 sq ft, 36" wide, weighing approximately 45 lb per roll.

**No.50 Asbestos Waterproofing Felt, Perforated:** An asphalt-saturated and perforated asbestos felt furnished in rolls of 216 sq ft, 32" wide, weighing approximately 64 lb per roll.

**Laptite:** A fibrated solvent asphalt lap cement with a covering capacity of approximately 74 sq ft per gallon. Furnished in 5, 15, 30 and 55-gal containers.







PACKING



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## Packings

### *Other Data Sheets Available*

*Packings:*

- ★Circumferences and Areas of Circles . . . . . PK-40
- Competitive packing recommendations . . . . . PK-70 to 201
- ★Table of Decimal Equivalents . . . . . PK-40

★Catalog pages



## Johns-Manville Packings

Since the early 1870's, Johns-Manville has continuously progressed in experience and knowledge so essential in the manufacture of the many types of packings and gaskets necessary to satisfy the ever increasing and exacting demands of industry. Modern, completely equipped Johns-Manville Plants are strategically located throughout the country so that the many J-M Packing Distributors can supply quickly needed items for practically any service condition. And at the J-M Research Center, new packings are developed and existing ones improved to meet new demands.

In general, J-M Packings can be classified or grouped under twelve headings as given in the following paragraphs, together with the distinguishing names of the packings under each group.

**Molded Rod and Plunger Packings:** Sea\* Rings and Uneepac, the two packings in this group, are precision made, automatic in action and seal tightly with minimum amount of friction. Both are the first recommendation for any service and condition under which they can be used.

**Asbestos Fabric Rod, Plunger and Valve Stem Packings:** These packings are usually recommended for use against severe conditions in reciprocating service. In this group are Kearsarge\*, Superheat, Universal and Asbestos Hollow Core.

**Braided and Twisted Asbestos Rod, Plunger and Valve Stem Packings:** The packings in this group include Interlocked, Mogul, Jewett\*, High Temperature, Rajah, Centripac\*, Chempac, Acid-, Caustic-, and Gasoline-Resisting, White Lubricated, Thermo, Air, No.5 Rod, and No.731 Rod.

**Rubber and Duck, Rod, Plunger and Valve Stem Packings:** In general, rubber and duck packings are recommended for use against hot water and low-pressure steam. In this group are Cross-, H-P, and L-P Diagonal, Duro\*, and Besta-Monia.

**Ramie, Flax and Jute Rod and Plunger Packings:** These packings, widely used for cold water reciprocating engines, include Navalon\*, Flax, and Jute.

**Flexible Metallic Rod, Plunger and Valve Stem Packings:** For severe service under high pressure and high temperature conditions, this group consists of Flexible Metallic (styles made up of different types of metals), and Inconel.

**Plastic Rod, Plunger and Valve Stem Packings:** Tough, ductile packings which provide an effective



*The Johns-Manville Research Center where new packings are developed and existing ones improved to meet new demands*

seal with low friction. This group consists of Plastic (many styles), and Die-Formed Rings (custom-made from various J-M packing materials).

**Molded Packing Products:** Made to order from proved materials, these packings include Molded Packing Cups, No.80 Pump Cup Sets, V-Rings, Conepac, Cumpac\*, Clipper Seal, and Pump Valves.

**Piston Packings:** Made for long life to avoid time and labor involved in repacking pistons, this group consists of Universal, Hydraulic, and Tucks Coil.

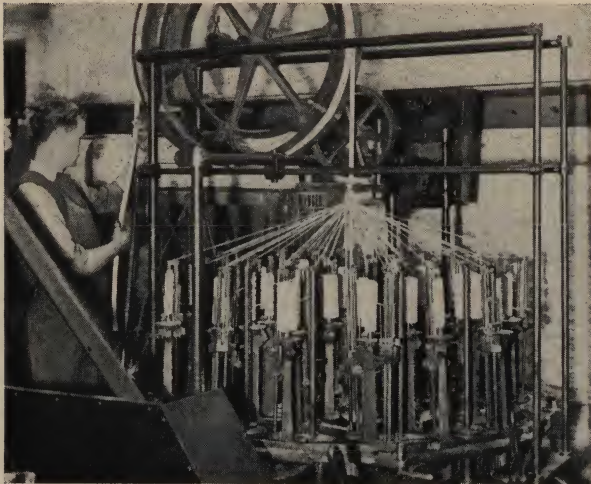
**Sheet Packings:** These packings stress uniformity of composition, resilience, density and resistance to deterioration. They include the following "sheets": Service\*, Felted Asbestos, Blue Asbestos Fiber, Kearsarge\*, Mobilene\*, Asbestos Fiber, Asbestos Coated Cloth, Liberty Red Rubber, Rubber and Synthetic Rubber, and Seigelite.

**Gaskets and Groove Packing:** Consisting of many styles to meet specific service conditions, the gaskets are cut from the sheet-packing materials mentioned. Others included in this grouping are Spirotallic\*, Goetze, Tubular Gasketing, Groove or Door, Tadpole, and Gasketing Tapes.

**Asbestos Wick, Rope and Cord Packings:** These are essentially general utility or emergency packings which are not confined to any specific service or set of conditions. Their use depends largely upon the resourcefulness and ingenuity of the user. They include Asbestos Wick, Asbestos Rope and Yarning Rope, Braided Asbestos Rope, and Twisted Asbestos Cord.

\* Reg. U. S. Pat. Off.





*Interlocked Braiding Machine*



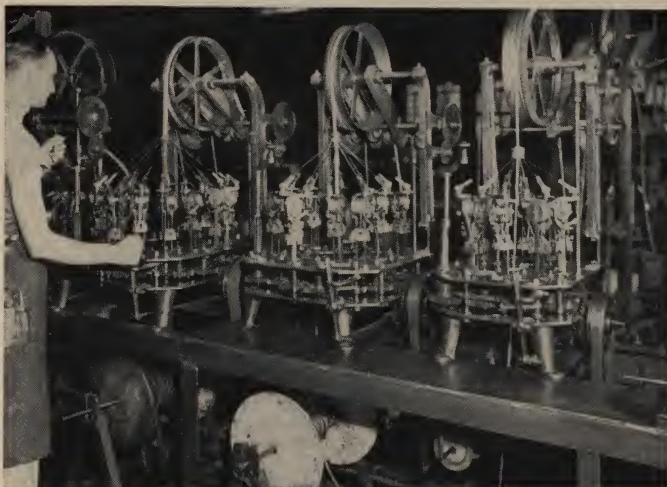
*Asbestos Rope-Twisting Machine*



*Asbestos Weaving Loom*



*Sheet Packing Sheeter Machine*



*Making Flexible Metallic Packings*



*Battery of Molding Presses*



## Molded Rod and Plunger Packings

The outstanding Johns-Manville packings are Sea Rings and Uneepac. Both are automatic packings for reciprocating rods and plungers operating against steam, water, air, gas and oil, where the rod is in line, true and not scored. Sea Rings or Uneepac are the first recommendation for any service and condition under which they can be used.

**Sea Ring Packing:** A molded packing made of asbestos fabric or duck, or a combination of the two, impregnated with heat and oil-resisting compounds selected to meet the particular service conditions. The flexible tapered lip is held tightly to the rod on the work stroke by the pressure of the fluid, but is automatically released on the return. Since unnecessary friction is eliminated, Sea Rings reduce wear on the rod, minimize the amount of power required, and by their longer life reduce the need for frequent replacements with attendant shut-down of equipment. The rings are made to fit any reciprocating rod and stuffing box where the rod is not less than  $\frac{3}{4}$ ", and the width of packing space is not less than  $\frac{5}{16}$ ".

Sea Rings are furnished in sets only, usually one header ring, two or more Sea Rings, and one follower ring, packed one or more sets per box, depending upon their size, and properly marked for identification. In ordering, it is essential that complete information be given on forms obtainable from any Johns-Manville office, salesman or packing distributor.

**Uneepac Packing:** A molded packing, composition varying with service conditions, which provides effective



*Johns-Manville Sea Rings are recognized as the best packing ever developed for use on reciprocating rods and plungers*



*Uneepac, the automatic ring packing, provides effective sealing with a minimum packing depth*

tive sealing with a minimum packing depth. Designed so that each ring is a complete packing unit, Uneepac employs fewer rings than are ordinarily required for automatic packings and is easy to install. This packing gives long, trouble-free service with minimum attention, reducing costly shutdowns for packing replacement. When assembled in a set, the rings nest so as to form spaces between the lips and the heels, permitting fluid pressure to act upon each lip individually. At the same time, the lip section is sufficiently supported to prevent collapse or distortion under pressure. Each ring correctly centers itself on the preceding ring owing to the design of the center section, assuring perfect nesting.

Uneepac is furnished in sets of endless or split rings. A set consists of one or more Uneepac rings, with or without header and follower rings as required. Two types are supplied: one for rings with flange widths up to and including  $\frac{1}{2}$ ", and another for flange widths over  $\frac{1}{2}$ ". Uneepac is available in sizes from  $\frac{5}{8}$ " ID to 63" OD.

### MOLDED ROD AND PLUNGER PACKINGS

February, 1952 (Cancelling PK-2, PK-3 and PK-4 dated in 1945)

PK-2



## Asbestos Fabric Rod, Plunger and Valve Stem Packings



*The construction of the center is one of the reasons for the resiliency and longer life of Kearsarge*

**Kearsarge Rod Packing (Styles No.166 and 15):** Kearsarge is an asbestos fabric packing which possesses great durability and the ability to retain its original pliability and resiliency under continuous high-temperature and high-pressure service. It serves against steam, air or gas for temperatures up to 500 F. Style No.166 is made of an accordion-folded center block of asbestos cloth and a non-hardening rubber expansion back, then wrapped with two layers of asbestos cloth, and impregnated with a preserving lubricant. In sizes  $\frac{9}{16}$ " and under, a center core of asbestos replaces the folded block. Style No.15 is constructed the same as No.166 except it has no rubber cushion. Both styles, in sizes  $\frac{1}{4}$ " and up, are for use where the packing space is  $\frac{3}{8}$ " and more. They are available in coil, spiral and ring form.

**Superheat Steam Rod Packing (Styles No.167 and 168):** This asbestos fabric packing provides long, highly efficient service when used on rods, plungers and valve stems operating against high temperature steam between 500 and 750 F. It is made of asbestos cloth, frictioned with a heat-resisting compound. The cloth is then rolled square, impregnated with a heat-resistant lubricant and graphited. Style No.168 is made with wire insertion. Superheat is furnished,  $\frac{1}{4}$ " and up, in coil, spiral and ring form.

**Universal Rod Packing (Style No.32):** Universal,

in the asbestos fabric group, is an exceptionally resilient packing for wet steam conditions and for rods that are scored or out of line. It is used against saturated steam up to 500 F and pressures up to 300 psi, especially where condensation is present in considerable quantity. Universal also is used against hot or cold water and air; for expansion joints where great resiliency is required; and in combination with other types of packing as alternate rings. The packing is made of asbestos and cotton fabrics frictioned with a resilient, heat-resisting rubber compound, wrapped around a non-hardening round rubber core, then lubricated and graphited. Universal is supplied, sizes  $\frac{1}{4}$ " and up, in coil, spiral and ring form.

**Asbestos Hollow Core Rod Packing (Style No.385):** Style No.385, and asbestos cloth hollow core packing, is designed for service against hot water and low-pressure steam, especially where great resilience is required. The hollow core provides for easy expansion and contraction. The packing is formed square, lubricated and graphited. It is furnished,  $\frac{1}{4}$ " and up, in coil, spiral and ring form.

**Rubber and Duck Hollow Core Rod Packing (Style No.390):** This packing, similar to Style No.385, is made of rubber-frictioned duck for lower temperature steam and water services. Supplied in coil, ring and spiral form in sizes  $\frac{1}{4}$ " and up.



## Braided and Twisted Asbestos Rod and Plunger Packings

**Interlocked Braided Rod Packing (Styles No.253, 254, 255, 256, 257, 259, and 270):** An interlocked braided asbestos packing which is braided solid and cannot ravel or come apart in service. Styles No.255 (no wire) and 257 (wire-inserted) are for use against saturated or superheated steam up to 500 F, hot or cold, fresh or salt water, oils, weak acids and caustics. Both are furnished lubricated and graphited. Style No.253, lubricated but not graphited, for pulp and paper mill service. No.254, lubricated and ungraphited, for service against caustics. No.256, lubricated and ungraphited, for service against beer. No.259, lubricated and graphited, for gasoline service. No.270, impregnated with Neoprene, lubricated and graphited, for service against severe hot oil conditions. No.270 is also particularly recommended for use on reciprocating pumps and as end rings or alternate rings with J-M Plastic Packings on centrifugal pumps. All Interlocked Styles available,  $\frac{1}{4}$ " and up, in coil and ring form.

**Mogul Rod and Valve Stem Packing (Styles No.193, 222 and 223):** A twisted or braided asbestos packing, lubricated and graphited, designed for general utility service for reciprocating and centrifugal rods with small packing spaces, and valve stems. It provides excellent service against air, water, brine, ammonia, oil and many weak acids and caustics, or for many uses where a packing containing no rubber is required. Style No.193 is twisted and by untwisting the strands, any desired smaller sizes may be obtained. No.222 braided round; and No.223 braided square. All three styles are furnished in coil form. No.223 is also available in ring form. Sizes: No.193,  $\frac{1}{16}$ " and up; No.222,  $\frac{1}{8}$ " and up; No.223,  $\frac{3}{16}$ " and up.

**Jewett Rod and Valve Stem Packing (Styles No.9, 10, 13 and 14):** Jewett is made of braided jacket-over-jacket of asbestos yarn and fine copper wire, over a lead-ribbon core (Styles No.9 and 10), formed square, and lubricated and graphited. The packing is for severe heavy duty service against crude and heavy oils, tar, molasses and other heavy, gummy fluids. It is also suitable for service against steam; fresh or salt, hot or cold water; air, gas and some chemicals requiring a packing free from rubber. Style No.10 has a heavy bodied lubricant which is retained without bleeding in valve stem service. Style No.9 has a lighter bodied lubricant and is more resilient for use where the packing has to conform to slight irregularities. Style No.14, specially lubricated for high temperature



*Style No. 255, a patented interlocked braided asbestos packing for reciprocating and rotating service*

service, is made without the lead ribbon core. Style No.13 is similar to No.14 except mica is used for coating in place of graphite, for use with stainless steel valve stems. All four styles,  $\frac{1}{8}$ " and up, are furnished in coil and ring form.

**High Temperature Valve Stem Packing (Styles No.398 and 399):** A packing designed to meet the trend toward higher temperatures and pressures in modern steam generating equipment where it is essential that a tight, lasting seal be held against superheated steam and dry gases under high pressures and temperatures of 900 F and over. It is also suitable for expansion joints and slow moving reciprocating rods operating under similar conditions. Style No.398 is made of asbestos yarn reinforced with tough, heat and corrosion-resistant Monel wire, braided over a plastic core, mica lubricated. Style No.399 is the same as No.398 but without Monel wire insertion. Both styles,  $\frac{1}{4}$ " and up, supplied in coil, spiral and ring form.

**Rajah Rod and Valve Stem Packing (Styles No.2 and 6):** The two major characteristics of Rajah packing are impenetrability and great resistance against superheated steam and other high-temperature conditions. This rod and valve stem packing is made of asbestos yarn, braided solid. It is then surface-treated with a heat-resisting compound and graphited. Style No.2 is furnished in round cross-section and coil form,  $\frac{1}{8}$ " and up. Style No.6 in square cross-section,  $\frac{3}{16}$ " and up, is available in both coil and ring form.





*Centripac has been widely used for many years for centrifugal pumps and other rotating or oscillating rods*

Centripac Rod Packing (Styles No.7, 11, 18 and 19) : This packing is plaited square from asbestos yarn, with or without wire in each strand depending on the style, and thoroughly lubricated and graphited. It is widely used for centrifugal pumps and other rotating and oscillating rods and shafts against fresh or salt, hot or cold water, oil, ammonia, brine, gasoline, and some weak acids and chemicals. Style No.7, no wire, is a soft packing for general service but dense enough to stand up well in service. Style No.11, wire insertion, is for heavy duty service against heavy fluids or wherever mechanical strength is required. Style No.18, specially lubricated and without wire, for service against hot or cold gasoline and other petroleum solvents. Style No.19, without wire or graphite and specially impregnated with a stainless lubricant, is designed for packing white water and stock pumps, Jordans and Refiners, in Pulp and Paper Mill Service. All styles,  $\frac{3}{16}$ " and up, furnished in coil and ring form.

Chempac Rod and Valve Stem Packing (Styles No.2011, 2012 and 2013) : Chempac is a Teflon-protected asbestos packing designed to meet practically every need of the chemical and process industries. The strong, resilient asbestos packing base is thoroughly treated with chemically inert Teflon. Chempac, for temperatures to 525 F, is used for packing pump rods or shafts, valve stems, agitator shafts, expansion joints, rotary filters, mixers and similar apparatus against many acids, alkalis, caustic solutions, solvents of any degree of activity and many other active chemicals in regular use in industry. Practically the only exceptions are molten alkali metals like sodium and potassium at elevated pressures and temperatures, and fluorine at elevated pressures. Style No.2011, the hardest Chempac

packing, serves for general purposes and is especially suitable for reciprocating rods. Mechanical lubrication should be provided. No.2011 serves where contamination of fluids is to be avoided and where higher than average pressures are encountered. Style No.2012, softer than No.2011 and containing a lubricating medium, is recommended where sealing with a minimum of gland pressure is required. It is particularly adaptable for valve stems and centrifugal pumps. Style No.2013, similar to No.2012, is especially lubricated for equipment handling chlorine, either gas or liquid. All styles are available in coil, spiral and ring form.

Acid-Resisting Rod Packings (Styles No.2015, 2016, 2017 and 2018) : These packings are made from blue African "crocidolite" asbestos fiber which has greater acid resistance than the "chrysotile" asbestos from which most J-M packings are made. Since the crocidolite fiber is harsher and more abrasive, chrysotile packings such as Interlocked, Mogul, or Centripac are easier on the rod and should be tried wherever the conditions are mild. Whenever possible, mechanical lubrication is advisable in acid service. The packings are impregnated with an acid-resisting lubricant during manufacture. Style No.2017, for rods, plungers and valve stems, is braided jacket-over-jacket and formed square. Contains no metal. Style No.2018, for centrifugal service, is plaited square without metal. Style No.2016, for valve stems, is twisted round and contains no metal. This style can be untwisted to make any size. Style No.2015, plaited square from blue asbestos yarns and a non-abrasive lead alloy, serves against acids which do not affect lead alloys, such as sulphuric and sulphurous. All styles,  $\frac{1}{4}$ " and up, are furnished in coil and ring form.



**Caustic-Resisting Rod Packings** (Styles No.2020, 2021 and 2022) : For service against caustic soda and similar corrosive chemicals, these packings are made of asbestos yarns and impregnated with a special caustic-resisting lubricant; ungraphited unless otherwise specified. Style No.2020, for rods, plungers and valve stems, is braided jacket-over-jacket and formed square. Style No.2021, for centrifugal service, is plaited square. Style No.2022, for heavy duty service, is plaited square from asbestos yarn and non-abrasive metal. All styles,  $\frac{1}{4}$ " and up, are supplied in coil and ring form.

**Gasoline-Resisting Rod Packings** (Styles No.293, 322, 323 and 604) : This versatile packing, for use on rods and valve stems of equipment handling gasoline and other non-lubricating petroleum products, is made of asbestos yarns impregnated with a gasoline insoluble lubricating compound and graphited. Seepage is prevented without excessive gland pressure. Style No.293 (twisted round) is the handiest style since it can be untwisted to form any desired size. Style No.322 (braided round) serves where a solidier packing than No.293 is desired. Style No.323 (braided and squared) is of denser construction preformed to completely fill the packing space. Recommended for reciprocating pumps in gasoline service. Style No.604, an exceptionally low friction and long wearing plastic packing, is made by braiding an asbestos jacket over a plastic core containing a lubricant that is insoluble in cold gasolines, naphtha, light oils, other hydrocarbons and many commercial solvents. Styles No.293 and 322,  $\frac{1}{8}$ " and up, furnished in coil form; No.323,  $\frac{1}{8}$ " and up, in coil and ring form. Style No.604,  $\frac{1}{4}$ " and up, is available in coil form.

**White Lubricated Rod Packing** (Styles No.2035 and 2036) : This packing, for use against food products and other fluids that must be kept free of color, taste and odor, is made of asbestos yarns impregnated with a colorless lubricant. Style No.2035, for reciprocating service, is braided jacket-over-jacket then formed square and lubricated. Style No.2036, for centrifugal service, is plaited square and lubricated. Both styles,  $\frac{1}{4}$ " and up, are supplied in coil and ring form.

**Thermo Rod Packing** (Style No.789) : This heavy duty packing is for service only against high temperature oils, gases and steam on reciprocating rods and plungers. Thermo Rod is made of asbestos yarn jackets braided over a center core of twisted asbestos containing annealed iron wire. Between the jackets is a small amount of heat-resisting compound. Furnished square or round, coil or ring form, with or without lubricant and graphite finish. Unless otherwise specified,



*Gasoline-Resisting Rod Packing is made to withstand the exacting service essential for equipment handling gasoline and other non-lubricating products*

supplied square without lubricant or graphite. Against superheated steam it should be ordered lubricated. Available in sizes  $\frac{1}{4}$ " and up.

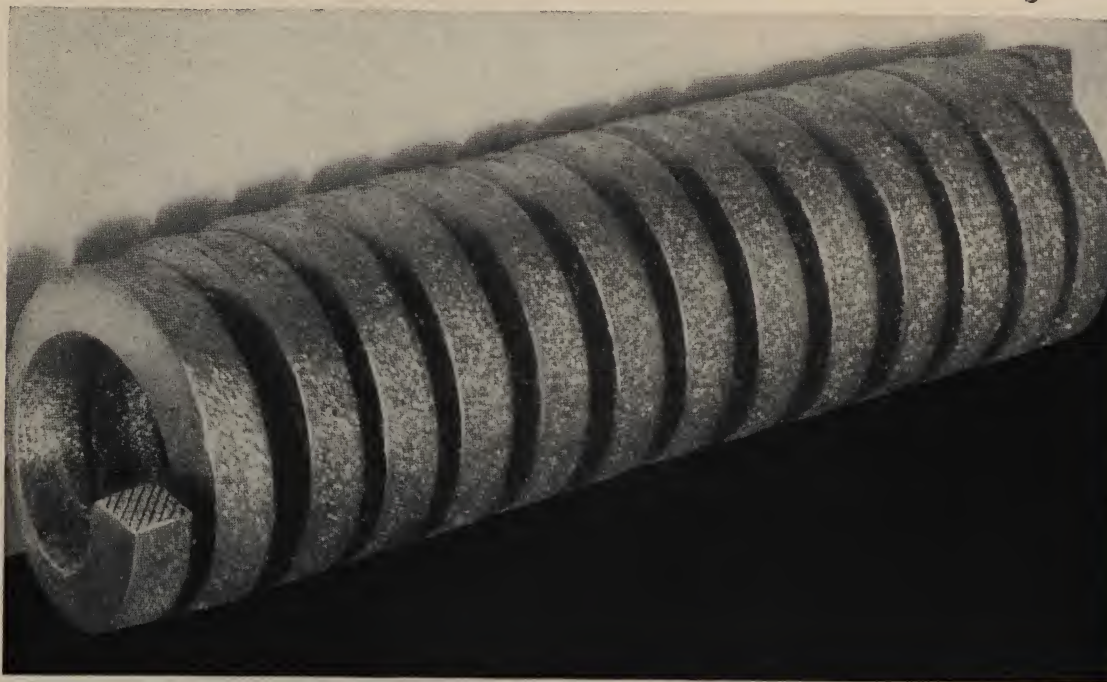
**Air Packing** (Style No.55) : For air service, particularly on the air end of compressors, this packing is made of braid-over-braid of asbestos yarn reinforced with fine copper wire, impregnated and graphited. Furnished,  $\frac{1}{4}$ " and up, in coil and ring form. When ordering combination air-compressor packing sets (Kearsarge R-15 and Air R-55, designated Style No. R-15-55) the make and size of the air pump should be specified.

**No.5 Rod Packing** (Style No.5) : For use on valve stems against hot oil or superheated steam, No.5 is plaited square from copper wire-inserted asbestos yarns lubricated with a heat-resisting compound. Furnished,  $\frac{1}{4}$ " and up, in coil and ring form.

**No.731 Rod Packing** (Style No.731) : A general utility rod and plunger packing for hot oil service, No.731 is a dense packing made by the braid-over-braid method with a sealing compound between the jackets. Furnished regularly unlubricated and ungraphited, but can be supplied with graphite finish if so ordered. In coil and ring form,  $\frac{1}{4}$ " and up.



## Rubber and Duck Rod and Plunger Packings



*The angular construction of Cross Diagonal Rod Packing allows for expansion*

**Cross Diagonal Rod Packing (Style No.271):** This packing is made of plies of duck, laid diagonally, and bonded with a rubber compound and graphited. The unusual expansion in either direction make it ideal for hot water service, even on rods which are slightly out of line. Cross Diagonal may also be used against cold water, low-pressure steam, ammonia, light oils and mineral seal oil. This packing should always be installed with the plies pointing toward the pressure. Furnished,  $\frac{1}{4}$ " and up, in coil, spiral and ring form.

**H-P Diagonal Rod Packing (Style No.183):** A utility packing designed for service against medium and l-p steam where the rods are worn, scored or out of alignment. It is made of a round rubber and duck cushion combined with cut wedges of rubber-frictioned laminated duck, held together with a braided cotton jacket; all thoroughly lubricated and graphited. This type of construction provides for automatic shifting of the individual units without distorting or damaging the basic structure of the material. Furnished,  $\frac{3}{8}$ " and up, in coil, spiral and ring form. (The muslin wrapping, for protection in shipping, should be removed before using.)

**L-P Diagonal Rod Packing (Style No.184):** The same general construction as H-P Diagonal except that

the round cushion is made of plaited jute instead of rubber and duck. It is particularly recommended against cold water as well as l-p steam on rods and plungers in poor mechanical condition. Furnished,  $\frac{3}{8}$ " and up, in coil, spiral and ring form. (The muslin wrapping, for shipping protection, should be removed before using.)

**Duro Rod Packing (Style No.171):** Duro Rod is a good dependable packing against l-p hot or cold water and steam where temperatures are not excessive. It will give satisfactory service on piston and valve rods on many types of reciprocating engines and pumps. Made of heavy laminated duck bonded together with a non-hardening rubber friction compound, then thoroughly lubricated and graphited. Furnished,  $\frac{1}{4}$ " and up, in spiral and ring form. The rings are available solid, R-171; sectionally cut, R-171-S.C.; diagonally cut, R-171-D.C.; and cut from coil, R-171-C.

**Besta-Monia Rod Packing (Style No.172):** Designed especially for reciprocating rods and plungers against ammonia, this packing is made of laminated duck bonded with an ammonia-resisting compound, lubricated and graphited. Furnished,  $\frac{1}{4}$ " and up, in spiral and ring form. The rings are made up the same as the Duro Rod Packing.



## Ramie, Flax and Jute Rod and Plunger Packings

**Navalon Packing (Styles No.175, 190 and 245) :** This packing is made from ramie fiber which outlasts other high-grade packings designed for cold liquid service. It delivers outstanding performance on pumps, elevators, accumulators, presses and reciprocating rods and plungers against fresh or salt water, brine, cold oil and many other liquids. Since Navalon contains and retains a higher percentage of lubricant, it is particularly adaptable for stern tubes, rudder posts and other severe marine service. Style No.175 complies with the requirements of the Navy (Spec. 33-P-42) and has been accepted both by the Bureau of Ships and the Maritime Administration. Styles No.190 and No.245 (W.P.H.), for industrial use, are designed for reciprocating service against fresh or salt water, brine, cold oil and many other liquids. All styles,  $\frac{1}{8}$ " and up, furnished in coil form.

**Regular Lubricated Flax Packing (Styles No.188, 189 and 2000) :** These braided flax packings are recommended for service against fresh or salt cold water and brine. The chief difference is the length of fiber used in their manufacture. All regular lubricated flax packings are furnished standard without graphite; graphited when so specified. They can also be furnished with more lubrication than standard if ordered D.D. (double-dipped). Style No.188, the highest quality flax packing obtainable, is impregnated with a cold-water lubricant and can be identified by the black diamond-shaped markings. Style No.189, next to No.188 in quality, is very satisfactory for normal service. It is marked with red diamond-shaped markings for identification. Style No.2000 is a medium quality blended flax and jute packing which is as carefully braided as the other styles. Furnished  $\frac{1}{4}$ " and up, in coil and ring form (No.2000, coil only).

**W.P.H. Lubricated Flax Packing (Styles No.240, 181 and 3000) :** W.P.H. (Waterproof Hydraulic) Flax Packings differ from the regular lubricated flax packings in that the impregnation is harder and denser, making them more suitable for heavy-duty, high-pressure service such as on accumulators, hydraulic presses, rams, etc. All styles are available in three densities: hard (H), medium (M) and soft (S). Medium density is furnished unless specified otherwise. For service where a graphite finish is objectionable (paper stock and white water pumps, etc.) they can be furnished without graphite. Style No.240, the highest quality W.P.H. flax packing, is lubricated with a pure type of



*Navalon is made from ramie fiber which outlasts other high-grade packings designed for cold liquid service*

wax best suited for high pressure, cold water service, and graphited. It can be identified by small grooves on opposite sides. Flax packing, Style No.181, is designed for moderately severe hydraulic service. Style No.3000 is made of blended flax and jute with W.P.H. lubrication. All styles furnished,  $\frac{1}{4}$ " and up, in coil, spiral and ring form (No.3000, coil only). For certain stuffing box conditions to break the pressure, packings No.280 Braided Copper, No. 182 Aqua Hydraulic, or No.33 Universal are often used as header and follower rings with the Flax Packings.

**Jute Packings (Styles No.4191 and 4181) :** These cold water, braided jute packings are for use where service conditions are not severe or where the cost and inconvenience of re-packing are not important factors. Style No.4191 (Regular Lubrication), when requested, can be supplied with more lubrication than standard if ordered D.D. (double-dipped). Style No.4181 (W.P.H. Lubrication) is similar to No.4191 except that it is treated with a waterproof hydraulic compound and graphited. It is used for heavier duty service than Style No.4191. Both styles,  $\frac{1}{4}$ " and up, are furnished in coil form.



## Flexible Metallic Rod and Plunger Packings

Flexible Metallic Packings are made to withstand severe service under high-pressure and high-temperature conditions on all types of reciprocating and rotating rods, shafts and plungers in good mechanical condition. However, flexible metallic packings should never be used against rods or shafts made of brass or bronze.

**Style No.280 (Square-Braided Copper):** Widely used as header rings on high pressure service; as end rings when packing heavy horizontal plungers; and as bushing rings where excessive clearance exists between the wall of the stuffing box and the rod. In combination with other packings such as No.245 Navalon or No.240 Flax, it is recommended for packing high-pressure hydraulic accumulators and accumulator pumps. Supplied in coil and ring form,  $\frac{1}{4}$ " and up.

**Style No.282 (Braided Copper with Asbestos Channel):** Recommended for the same general types of service as Style No.280 except it will not withstand quite as heavy pressures. However, because of the channel it has greater resiliency. Supplied in spiral and ring form,  $\frac{3}{8}$ " and up.

**Style No.350 (Plaited Asbestos and Lead):** Plaited square from ribbons of non-abrasive metal and asbestos yarn, thoroughly lubricated and graphited, No.350 is designed for use on centrifugal pumps operating against high or low-pressure steam, air, water and oil up to 500 F. It can also be used on reciprocating rods and plungers either alone or in combination with other packings. In coil and ring form,  $\frac{1}{4}$ " and up.

**Style No.351 (Plaited Asbestos and Lead):** Constructed and used the same as No.350, except No.351 is specially lubricated for service against gasoline and other distillates. Supplied the same as No.350.

**Style No.360 (Asbestos Core and Lead):** Composed of lead alloy ribbons slightly knurled to retain



*Style No. 280 Square-Braided Copper*

lubrication and braided over an asbestos core, this resilient packing serves for centrifugal pumps handling hot or cold water, oil, etc., up to 500 F. Only for shafts running true and without vibration. It can also be used for reciprocating rods and as header and follower rings, or alternate rings with Plastic Coil Packings on centrifugal pumps, especially at speeds over 1750 rpm. Supplied,  $\frac{3}{16}$ " and up, in spiral and ring form.

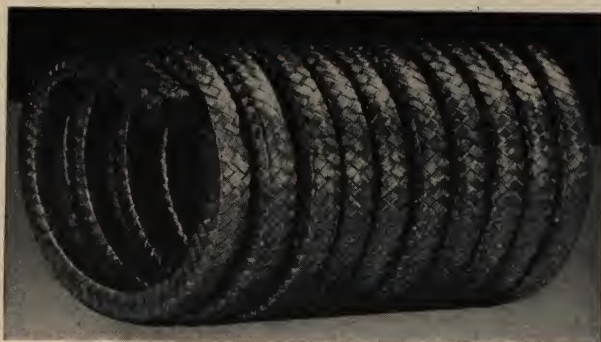
**Style No.361 (Asbestos Core and Lead):** The same as No.360 but specially lubricated for service against gasoline and other distillates. Supplied the same as No.360.

**Style No.362 (No.360 in Asbestos Channel):** The asbestos channel provides greater resilience. Used in combination with other packings for temperatures to 500 F against air, steam, ammonia and gas. Supplied,  $\frac{3}{8}$ " and up, in spiral and ring form.

**Style No.363 (No.360 in Duck Channel):** Especially suitable for use on elevator rams, water works plungers, presses, and in combination with other packings. Furnished in spiral and ring form,  $\frac{3}{8}$ " and up.

**Style No.365 (Braided Copper over Asbestos Core):** For temperatures over 500 F, this packing is made by braiding copper ribbons over an asbestos core for use on slow moving rods and expansion joints where high temperatures are encountered. Recommended for steam, oil, etc., it can be used alone, or as a header and follower or alternate rings in combination with plastic packing. Furnished,  $\frac{1}{4}$ " and up, in spiral and ring form.

**Style No.379 (Braided Lead over Asbestos Core):** This style, composed of lead alloy ribbons braided over a core of blue African asbestos, serves as header and follower rings with plastic coil packings (such as Style



*Style No. 360 Flexible Metallic Packing*



No.640) for centrifugal pumps handling sulphuric and sulphurous acids in pulp and paper mills and chemical plants. Furnished,  $\frac{3}{16}$ " and up, in spiral and ring form.

Style No.391 (Aluminum Foil): For service against steam, air, oil and petroleum derivatives up to 1000 F, No.391 is made of aluminum foil, graphited, lubricated, twisted and wrapped upon itself and formed into square cross-section. Supplied in spiral and ring form,  $\frac{1}{4}$ " and up.

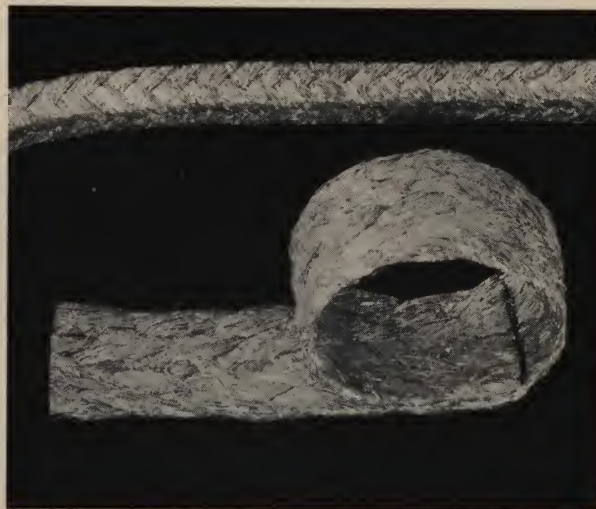
Style No.392 (No.391 with Asbestos Core): The asbestos core provides for greater resiliency than No.392. It is recommended for temperatures to 750 F. Supplied the same as No.391.

Style No.393 (Lead with Asbestos Core): Used for centrifugal pumps handling gasoline, propane, butane and other petroleum derivatives up to 450 F. This style is made of lead foil graphited, lubricated, twisted and wrapped over an asbestos core and formed into square cross-section. Supplied,  $\frac{1}{4}$ " and up, in spiral and ring form.

Style No.394 (Lead with Asbestos Core): The same as No.393 except that it is lubricated for service against steam, water, brine and oil for temperatures to 450 F. Supplied the same as No.393.

Style No.395 (Aluminum Foil with Core): An aluminum foil packing made with a core of twisted aluminum mesh to impart resiliency. It is recommended for centrifugal pumps handling hot oil up to 750 F. Furnished in spiral and ring form,  $\frac{1}{4}$ " and up.

**Inconel Packing (Styles No.2559 and 3123):** A flexible metallic packing that withstands temperatures to 2000 F and is outstanding in its resistance to the heat and corrosion of most gases, alkalies, and acids. As the name implies, Inconel Packing is made of the nickel-chromium-iron alloy known as Inconel. This material, in fine wire form, is knitted into mesh and then tightly braided to produce the finished packing, which is highly resilient, non-scaling and non-magnetic. Inconel is the only type of packing which has met the test of service in the exhaust systems of fighting planes, withstanding temperatures to 2000 F and successfully resisting the destructive attacks of highly corrosive gases. Even under such extreme conditions as the incessant vibration set up by powerful airplane engines, it affords a perfect expansion joint between stationary and moving parts. Although originally developed for the aircraft industry, Inconel is highly satisfactory against high temperature corrosive gases and liquids encountered in other industries. It has



*Inconel withstands temperatures up to 2000 F and is outstanding in its resistance to corrosion*

proved superior for such services as superheated valve and other steam fittings, conduit connections in the chemical industry—in fact, for virtually any service where strength and resiliency must be combined with unusual resistance to heat and corrosion.

Style No.2559 is furnished in square cross-section,  $\frac{1}{8}$ " and up, and in tape form  $\frac{1}{2}$ " wide by  $\frac{1}{8}$ " thick, or to specification. Information on special shapes and sizes furnished on request.

Style No.3123, in addition to the all-metallic Style No.2559, is furnished with an asbestos sealing medium combined with the Inconel alloy. No.3123 provides excellent resiliency with a lower porosity factor. Furnished in square cross-section  $\frac{1}{4}$ " and up.

**Other Flexible Metallic Packings (Styles No.342, 343 and 344):** In addition to Inconel Packing, J-M manufactures other styles braided from knitted wire mesh. The characteristics of the fabricating metal used largely determines the service for which the individual packing is best adapted. Style No.342 (Monel) combines highly corrosion-resistant Monel, a nickel-copper alloy, with asbestos, then braided square and graphited. For temperatures to 1000 F, it is supplied in coil form in sizes  $\frac{1}{4}$ " and up. Style No.343 (Monel) is a mica-lubricated Monel and asbestos packing recommended for high temperature service on stainless steel valve stems. Supplied in coil form,  $\frac{1}{8}$ " and up. Style No.344 (Copper) is composed of square-braided copper mesh and asbestos yarn, lubricated with graphite. For valve stems and expansion joints, temperatures to 1000 F. Supplied,  $\frac{1}{4}$ " and up, in coil form.



## Plastic Rod and Plunger Packings

J-M Plastic Packings provide an effective seal with low friction for use on modern, high-speed rotating shafts. While adaptable to both reciprocating and rotating service, they are designed principally for high-speed centrifugal service. These ductile and pliable packings are installed the same as any other packing type and mold themselves in the stuffing box to form a solid, tight-sealing bushing. To prevent possible extrusion, it is always advisable to use header and follower rings of a suitable type of braided or flexible metallic packing.

The exact composition of J-M Plastic Packings varies according to the service conditions against which each particular style is designed to operate.

Selected asbestos fiber of proper type and length is combined with suitable binder materials to produce a uniformly homogeneous mixture of low friction throughout. It is formed into coils, spirals or rings of the proper density and size by extrusion through steel dies. The following styles,  $\frac{1}{8}$ " and up, are available to meet various service requirements.

**Style No.600:** Made of asbestos fiber and oil-resisting compounds for valve stems in general service as a seal against gasoline, oil, air, water and many other fluids. Available only in endless die-formed rings.

**Style No.610:** This style is composed of asbestos fiber mixed with pure graphite and a small amount of non-friction metal and bonded with a heat-resisting compound. Used as a general maintenance packing against steam, air, water, ammonia, gases, etc., up to 600 F. Available in coil, spiral and ring form.

**Style No.615:** The same as No.610, except that no metal is used, and adaptable to the same general service conditions. Made in coil, spiral, and ring form.

**Style No.620:** This style, made of asbestos fiber, pure graphite and a synthetic rubber oil-resisting binder, is especially designed for either hot or cold oil and gasoline service. In coil, spiral, and ring form.

**Style No.625:** Asbestos fiber is bonded with Buna N synthetic rubber in this style to make it especially resistant to the action of gasoline, petroleum products, hydrocarbons such as mineral oils, animal fats, vegetable oils, acids and alkalis. In spiral and ring form.



*J-M Plastic Packings were especially developed for use on modern high-speed rotating shafts*

**Style No.630:** A white plastic coil composed of asbestos fiber with a special lubricant and binder for use where graphite cannot be used, such as in equipment handling food products, alcohol, caustics, weak organic acids, etc. Supplied in spiral, coil, and ring form.

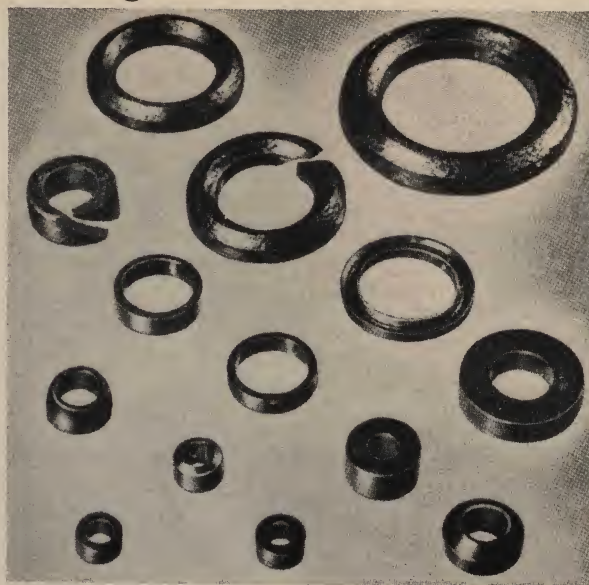
**Style No.640:** For service against such acids as sulphuric or sulphurous, blue African asbestos fiber is used with a non-friction lead alloy, graphite and an acid-resisting binder. This construction, used with No.379 Flexible Metallic or No.2017 or 2018 Acid-Resisting Packings, not only lasts longer than braided or plaited types, but its mild action is most economical in extending the life of rods. Furnished in spiral, coil, and ring form.

**Style No.645:** This style, similar to No.640 but without the lead, should be used for packing against acids which react with lead. No.645 is used with end rings No.2017 or 2018 Acid-Resisting Packing. Furnished in spiral, coil and ring form.



## Die-Formed Rings

**Die-Formed Rings:** These rings are custom-made to closely controlled dimensions to meet the most exacting requirements. They are furnished in virtually any required size and flange width, in many styles and compositions (with or without wire insertion) and are lubricated for specific service conditions. Manufacturers of valves, faucets, washing machines and similar equipment find that the mechanically perfect fit of these rings cuts production time. The rings are identified by the name of the packing material from which they are die-formed and used for the same service condition. For instance, Style R-9, especially for bibs and faucets with irregularities in castings, has the same composition as Jewett Packing R-9 and is recommended for the same kind of service. The styles shown in the table following are all split with a skive cut except Plastic and R-341 which are endless.



### SERVICE RECOMMENDATIONS

Name	Style No.	Recommended for	Description	Maximum Depths and Minimum Sizes		
				Flange Width	Max. Depth	Minimum Size
Jewett	R-10	Steam, water, air, gas, chemicals, crude and heavy oils, tar, molasses, etc. to 500 F.	Braided copper wire inserted asbestos jackets over a thin lead core, lubricated and graphited.	1/16" Over 1/16" thru 3/32" Over 3/32" thru 7/64" Over 7/64" thru 1/8" Over 1/8"	5/16" 3/8" 7/16" 1/2" 5/8"	3/16" x 5/16" x 3/16"
	R-9	Especially for bibs and faucets with irregularities in castings.	Same as R-10 except softer and with lighter bodied lubricant.			
	R-13 R-14	Same as R-10, over 500 F.	Same as R-10, except made of pure asbestos, no lead core.			
Mogul	R-223	Steam, water, oil, air, ammonia, brine, weak acids and caustics to 500 F.	Braided asbestos jackets, lubricated and graphited. More pliable than R-9.			
Gasoline	R-323	Hot or cold gasoline, naphtha, benzine, butane, propane and other solvents.	Same as R-223 but with solvent resisting lubricant, graphited.			
Rajah	R-6	Temperatures over 500 F. Also hot or cold water.	Braided asbestos jackets frictioned, graphited.			
Centripac	R-7	Same as for R-223.	Plaited asbestos yarns lubricated, graphited.	3/16" thru 1/2"	Flange +1/8"	3/4" x 1-1/8" x 3/16"
	R-11	Heavy duty service.	Same as R-7 but with copper wire insertion.	Over 1/2"	Flange +1/4"	3/8" x 3/4" x 3/16"
	R-18	Same as for R-323.	Same as R-7 but lubricated for solvents.			
Flexible Metallic	R-350	High or low pressure steam, air, water and oils to 500 F.	Plaited asbestos yarns with lead ribbons, lubricated and graphited.	3/16" thru 1/2"	Flange +1/8"	3/8" x 3/4" x 3/16"
	R-351	Same as for R-323.	Same as R-350 but lubricated for solvents.	Over 1/2"	Flange +1/4"	
Endless	R-341	Same as for R-223.	Braided asbestos jackets, frictioned, graphited.	3/32" and over	1/2"	1/4" x 7/16" x 3/16"
High Temp.	R-398	High temperature steam valves, dry gases, etc. over 500 F.	Wire-inserted braided jacket with plastic core.	Same general sizes as R-10 shown above.		
	R-399		Same as R-398 but without wire-insertion.			
Plastic	Various	Various fluids and gases.	Various compositions, depending upon service conditions.	1/16" Over 1/16"	3/8" 9/16"	1/8" x 1/4" x 1/4" Maximum O.D. endless, 1-1/2"
Chempac Teflon- Protected	R-2011 R-2012 R-2014	For general chemical conditions to 525 F.	Braided asbestos structure protected with Teflon treatment.	Same general sizes as R-10 shown above.		
	R-2013	For Chlorine service.				

#### DIE-FORMED RINGS

February, 1952 (Cancelling PK-13, 1934 and PK-14, 1945)

PK-8



## Molded Packing Products

**Molded Packing Cups:** The cups, especially designed and molded to the exact size and shape required, provide a definite advantage over conventional types of packings. They form a highly efficient seal, contributing both to lower maintenance costs because of their longer service life and to lower operating costs because of the improved performance of equipment on which they are installed. The cups are recommended for service on all types of slow-moving pistons and rams operating under high or low pressures and temperatures. Specific types of equipment include reciprocating pumps, power reverse gears, air brake cylinders, hydraulic jacks and presses, pneumatic chucks, compressors, governors, power shovels, grease guns, hydraulic and air-operated valves, grinders, drilling and boring machinery. The following types are available:

**Types A, B, and P**—Widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and wear and conserving power.

**The "U" Type**—This type is usually installed with one side forming the seal against the rod or plunger. It is molded with either a round or flat bottom to fit the shape of the gland follower and is regularly furnished with one or more filler rings of J-M Mogul, Flax or special molded packing. The filler rings hold the lips of the cups off the bottom of the stuffing box and maintain contact between the lips, rod and box.

**The "Hat" or Flange Type**—Commonly used on small rods or plungers where space is limited and a packing of small cross-section is required. It is also used as an oil seal on small, slowly rotating shafts.

**Ordering Molded Packing Cups**—All of the standard shapes described are available in composition to meet

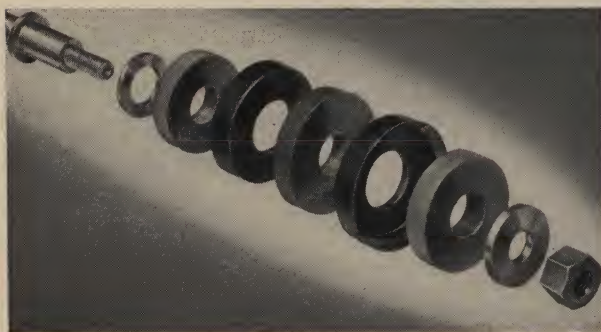


*Types shown: Top, Type A; middle, Hat-Shaped; right, U-Shaped*

a wide range of operating conditions. Since it is essential that full and accurate data be supplied, a "Molded Packing Cup Form" can be obtained at any Johns-Manville office. This form can be quickly filled out and includes such required information as type of service, type of machine, depth of stuffing box, etc.

**Style No.80 Pump Cup Sets:** These sets are Type A Molded Packing Cups furnished in sets for converting pumps equipped with conventional piston packings to the same efficient cup-type packings that are now used by leading pump manufacturers as original equipment. Each set consists of two cups and two followers, with spacer for straight shafts. The sets provide a precision fit on inside packed pistons, minimizing friction and virtually eliminating slippage past the piston. Performance records show that they generally outlast conventional packings several times over. Wear on liners is also minimized. Like all J-M molded packings, Style No.80 Pump Cup Sets are custom molded in various compositions, depending upon the operating conditions to be met. Since it is essential that complete dimensional data on the packing space be included, a special data form is available (at any J-M office) for this purpose.

**V-Rings:** This automatic packing is widely used on rods and plungers because of their automatic action and sensitivity to pressure changes. It is a favorite packing of many designers as it does not require great depth of packing space. When installed, the channels between each ring serve as reservoirs for the lubricant and contribute to uniform sealing action throughout the set. Since the flexible lips are entirely automatic, gland pressure is not required for the sealing action. Therefore, the gland should be adjusted so that the rings are



*Style No. 80 Pump Cup Sets*



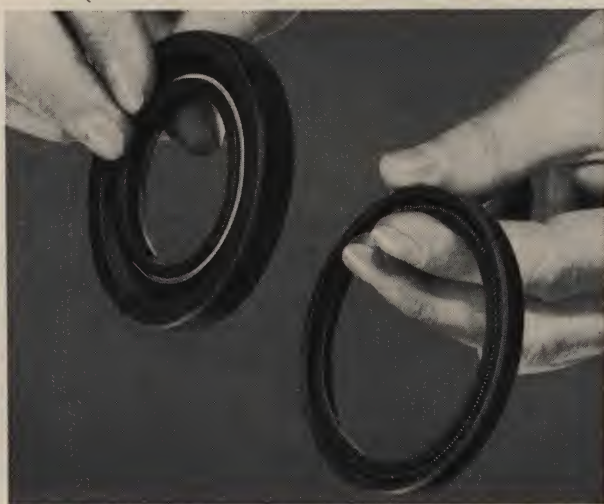
maintained in position without end play; no further attention should be necessary to compensate for pressure changes. V-Rings are supplied in a variety of compositions depending upon service conditions, in sizes to fit all normal rod diameters and flange widths, and in individual rings, or in sets with one bottom filler ring and an optional top adapter ring.

**Conepac Rod Packing** (Styles No.45, 46, 43 and 44) : Conepac assures fewer gland adjustments because its lip type design permits a greater number of sealing rings in a given packing depth and its sealing action is automatic, effective, low in friction and independent of gland pressure. The rings are supplied in various compositions to meet a wide variety of service conditions. All styles are accurately made to fit in the stuffing box at a 45-degree angle and should never be cut or otherwise distorted. Furnished in standard thicknesses of  $\frac{3}{16}$ " and up. The minimum flange width is  $\frac{3}{8}$ ".

**Style No.45**—Used in high-temperature service for turbine control and other valves against super-heated steam up to 750 F. Made of asbestos yarn with fine copper wire insertion, braided, molded and graphited. The wide over-lapping bevel joints seal tightly against leakage between joints.

**Style No.46**—For general service against oil, steam, etc., up to 500 F. Copper wire-inserted asbestos yarn, braided over lead ribbon core, molded, lubricated and graphited.

**Style No.43**—For oil, steam, etc., up to 500 F. Made of synthetic rubber compound and asbestos, molded and vulcanized under pressure.



*The Clipper Seals above have the same OD but vary in flange width. The light flange section (right) permits economy and compactness in design*



*V-Rings are widely used on rods and plungers because of their automatic action and sensitivity*

**Style No.44**—For high and low-pressure hydraulic service and for use against oil. Made of synthetic rubber and duck, molded and vulcanized under pressure.

**Cumpac Rod and Plunger Packing:** This packing combines the features of low friction contact with the rod and effective sealing action against the entire stuffing box area. The solid part of the packing taking the gland pressure, leaving the flexible lips free to act upon the rod or shaft. Actuated by fluid pressure, the lips provide a tight seal with minimum friction. Cumpac applications include elevator worm gear shafts, hydraulic valve rods, reciprocating and rotating rods, plungers and shafts. It has also been used successfully in severe applications such as on the outboard end of ship stern tubes. Cumpac is furnished, compositions per service conditions, in sets molded to size. Also available in fabric construction, formed to size and shape, lubricated and graphited. In addition to the molded styles, Cumpac (Style No.238) is furnished in endless or split rings, consisting of header and follower rings with the required number of Cumpac rings to make up the depth of set.

**Clipper Seal Packing:** This precision-molded, oil seal packing consists only of a one-piece molded body (the seal) and a garter spring for adjusting lip pressure. The tough, dense heel and soft, flexible lip are concentrically molded into a single unit. No metal case is required. Besides providing an effective lubricant-retaining, dirt-excluding seal of wide adaptability and long-wearing qualities, this construction simplifies installation and assures quick, easy removal without damage to the seal. The outer heel is resilient enough to conform to cavities that are slightly out of round and the garter spring helps the lip maintain contact even when bearing wear has caused slight eccentricity or shaft run-out.



The Clipper Seals are also furnished in split construction for easy application where there is only a minimum clearance and the seal cannot be applied over the end of the shaft. The self-adjusting garter spring has a hook and eye so that it is easily hooked around the shaft and then readily slipped into position in the groove of the seal.

Clipper Seals are available in light flange sections for as small a depth as  $\frac{1}{4}$ ", as well as in heavier flange sections. Also, they are readily adaptable back to back, face to face, or in tandem to form effective duplex seals. Garter springs are made for  $\frac{5}{8}$ " through 66"-diameter shafts; springless Clipper Seals for  $\frac{1}{4}$ " to  $\frac{5}{8}$ "-diameter shafts. Where severe corrosion is present, special corrosion-resistant alloy garter springs may be specified or the springless type SH Clipper Seal may be used.

In general, the standard lip designs are suitable: Type LA (Endless) for a wide range of conditions; Type R (Split) for easy removal and replacement; and Type SH (Springless and Endless) for small cavities and highly corrosive conditions.

Molds for standard styles of Clipper Seal Rings are already made up. Special sizes and shapes can also be made to meet individual specifications.

When ordering, give the diameter of the shaft, cavity bore diameter and bore depth, the lip design, fluid to be sealed, shaft speed in rpm or fpm, temperature and direct pressure upon the seal—not pump discharge or indirect pressure.

**Pump Valves (Styles No.300, 415, 416, 420, 424, and 430):** These valves are designed to provide perfect seating and long, highly efficient operation in every type of service. All are made from various rubber compounds, except No.300 which is constructed from plies of duck impregnated with resin gums.

Style No.300—for general service including hot or cold water, oils, naphtha, benzene, paraffin and weak acids, for pressures to 1000 lb and temperatures to 300 F.

Style No.415 (to 400 lb) and 416 (to 200 lb)—both used for cold water service. No.416 also used against fresh, salt or alkali water and other general industrial services.

Style No.420—for lake, marine and other severe condenser services.

Style No.424—for hot water against pressures to 300 lb and temperatures to 300 F.

Style No.430—for oils, acids, ammonia, syrups, etc., against pressures to 300 lb and temperatures to 300 F.



*There is a type of J-M Pump Valve for every service*



## Piston Packings

**Universal Piston Packings (Styles No.33 and 34) :**  
Used for many years as the highest quality packing for general service against water, brine, air, oils and some chemicals, in use on inside-packed pumps where the packing space is  $\frac{3}{8}$ " or over. Style No.33 is made of folded layers of asbestos and duck, bonded with a rubber compound and vulcanized to size in steel molds. The rounded shoulders of the folded cloth give greater flexibility and resiliency, and a longer life than most other types of piston packings. Style No.34 is essentially the same as No.33 except that the bonding compound is synthetic rubber, so that it is highly resistant to the action of gasoline, naphtha, propane, butane, and light hydro-carbons of a corrosive nature. Temperatures not to exceed 350 F. Both styles furnished,  $\frac{3}{8}$ " and up, in spiral, coil and ring form.

**Aqua Hydraulic Piston Packing (Style No.182) :**  
Used extensively against hot and cold water and oil, on inside packed pistons and as end rings in hydraulic sets. When used against extremely hot water, the packing should be ordered rock hard (R.H.). Made from fine white waterproof duck, cross-laminated and frictioned with a white rubber compound of excellent tensile strength. Aqua possesses uniformly high strength and resiliency with low absorption and minimum swell. Furnished,  $\frac{1}{4}$ " and up, in coil and ring form. Unless specified "solid," rings are furnished with step joint.

**Light Weight Hydraulic Piston Packing (Style No.295) :** With less tendency to swell than other types of piston packings, L.W. Hydraulic is particularly adapted to service against crude oil, gasoline, benzene,



*Universal Piston Packing has been recognized for many years as the highest quality packing for inside pumps in all general services*

naphtha, mineral seal oil, and hot or cold water. Also used as end rings in combination with other packings on outside packed rods and plungers operating against water or oil. It is made in laminated form from plies of heavy-duty duck, frictioned together with a light rubber compound. Furnished,  $\frac{1}{4}$ " and up, in coil and ring form; regular cure or R.H. (Rock Hard). Unless specified "solid," rings are furnished with step joint.

**Square Hydraulic Piston Packing (Style No.290) :**  
A medium-quality piston packing specifically recommended for service against hot or cold water and cold oil, in use on inside-packed pistons. Made from plies of duck, laminated with a rubber friction compound. Furnished,  $\frac{1}{4}$ " and up, in coil and ring form; regular cure or R.H. (Rock Hard). Unless specified "solid," rings are furnished with step joint.

**Tucks Coil Packing (Style No.186) :** Primarily designed as a cold-water packing for service on inside-packed pistons operating at medium pressure. Made from plies of heavy duck, frictioned together with a black rubber compound. Supplied in coil form only,  $\frac{1}{4}$ " and up.



*Aqua Hydraulic is a high-quality white piston packing of uniformly high strength*

### PISTON PACKINGS

February, 1952 (Cancelling PK-17, 1939 and PK-25, 1948)

PK-11



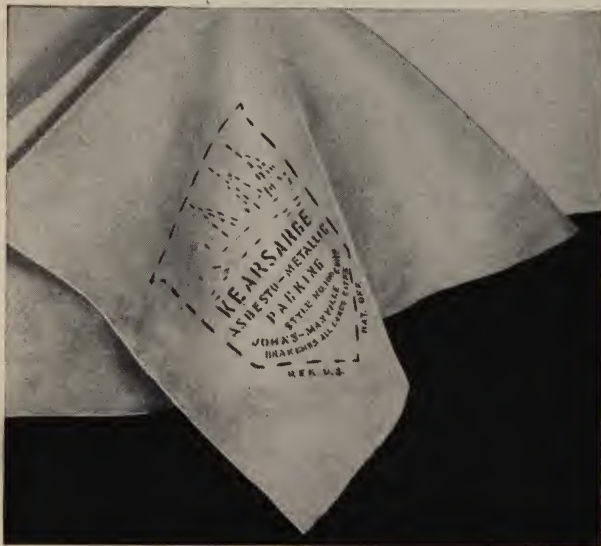
## Sheet Packings

**Service Sheet Packing (Styles No.60 and 61):** An unusually versatile sheet packing which is equally effective for service against superheated steam, air, gas, water, hot oil, ammonia, and many acids and chemicals. It provides a tight, long-lasting seal under practically any condition for which a sheet material of its type is suited. Made from selected long fiber asbestos and heat-resisting compounds bonded together under heat and pressure, the finished product is a tough durable sheet without plies or laminations. It is unusually pliable and resilient and does not dry out in storage. Style No.60 is graphited on one side; the other side is ruled into one-inch squares to facilitate measuring and cutting. No.60, if specified, can be supplied graphited on both sides. Style No.61 is furnished ungraphited. Both styles furnished in sheets 54"x63", 36"x126", 36"x63" and 54"x126", in thicknesses of  $\frac{1}{64}$ " to  $\frac{1}{4}$ "; also, 108"x126" in thicknesses of  $\frac{1}{32}$ " to  $\frac{1}{4}$ ". Service sheet is also furnished as cut gaskets in all standard and special shapes.



*Style No. 60 is the one sheet for all conditions*

*1500'* **Felted Asbestos Sheet Packing (Style No.219):** Made of long-fiber asbestos thoroughly felted together and bonded with a special heat-resistant, rubberless binder, compressed under heat and pressure into a sheet considerably stronger than most ordinary felted asbestos sheets. Designed primarily for high temperature conditions where rubber-bonded sheets would be objectionable. Made in sheets 42"x48",  $\frac{1}{32}$ " and up.



*Where flanges are rough and where a narrow flange gasket is necessary, Kearsarge is recommended*

**Blue Asbestos Fiber Sheet Packing (Styles No.83 and 84):** For acid service, this packing is made of blue African crocidolite asbestos fiber bonded with an acid-resistant binder for use against most of the acids encountered in chemical and industrial plants. Style No.83 is a soft, felted sheet furnished in thicknesses of  $\frac{1}{16}$ " and  $\frac{1}{8}$ " in 52"x58" sheets, and as cut gaskets. Style No.84 is a tougher sheet for use where a relatively hard, dense gasket is required. It is supplied in 36"x63" sheets in thicknesses of  $\frac{1}{32}$ ",  $\frac{1}{16}$ ", and  $\frac{1}{8}$ ".

**Kearsarge Sheet Packing (Styles No.100 and 98):** Style No.100 is particularly designed for use on rough flanges against low, medium or high-pressure steam, water and air. Also recommended where a narrow flange gasket is necessary or where many ports and bolt holes must be used. Made of tightly twisted asbestos yarn spun with brass wire for additional strength, woven into asbesto-metallic cloth and impregnated with a special heat-resisting compound. Furnished in 48"-wide rolls,  $\frac{1}{32}$ " to  $\frac{1}{4}$ " thick, and as cut gaskets. Style No.98 is recommended for use on rough flanges against gasoline, oil and other petroleum derivatives. It is similar to Style No.100 in general construction except that it is impregnated with synthetic rubber compound to provide maximum resistance to oil. Furnished in thicknesses of  $\frac{1}{32}$ " to  $\frac{1}{4}$ " in 48"-wide rolls, and as cut gaskets.

**Mobilene Sheet Packing (Style No.101):** One of the pioneers in asbestos sheet packing for use on various parts of gas and gasoline engines, Mobilene is still



unsurpassed for packing cylinder heads, exhaust manifold flanges and water jacket connections, especially in marine service. Made of a strong asbestos fabric, interwoven with fine brass wire, and impregnated with a compound to withstand high temperature and pressure. Coated with a red compound on one side and graphite on the other, so that a joint may easily be taken apart without destroying the gasket. Furnished in 48"-wide rolls,  $\frac{1}{32}$ " to  $\frac{1}{4}$ " thick, and as cut gaskets.

Other Asbestos Sheet Packings (Styles No.50,70, 71 and 76): This group of asbestos sheet packing consists of the following styles:

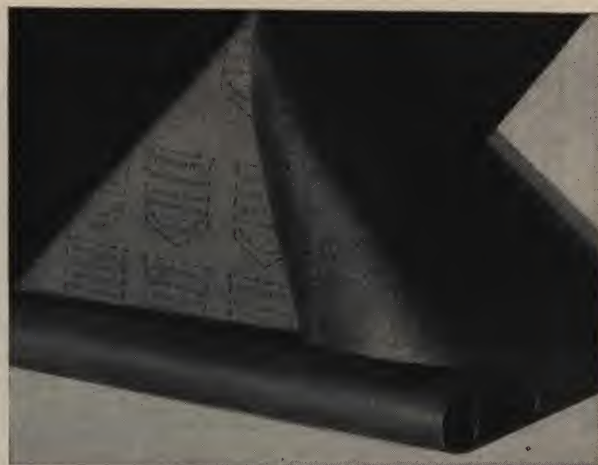
No.50—Asbestos Fiber Sheet—is similar to Style No.60 Service Sheet and is used against gas, air, or wherever a softer sheet than No.60, or an asbestos fiber sheet without sulphur content, is required. Furnished,  $\frac{1}{64}$ " and up, in sizes 54"x63", 54"x126", 36"x63", 36"x126"; and 108"x126" ( $\frac{1}{32}$ " and up). Also supplied as cut gaskets in all standard and special shapes.

No.70—Asbestos Fiber Sheet—Similar to Service Sheet (Style No.60) but harder and denser. Furnished in sheets 40"x42" and 36"x63",  $\frac{1}{64}$ " to  $\frac{1}{8}$ " thick.

No.71—Asbestos Fiber Sheet—A compressed sheet packing of long fiber asbestos with a bonding compound high in dielectric strength. For general service where a firm but flexible sheet with good electrical resistance is desirable. Furnished  $\frac{1}{64}$ " and up, in sheets 54"x63", 54"x126", 36"x63", 36"x126"; and 108"x126" ( $\frac{1}{32}$ " and up).



*Liberty is the preferred red rubber sheet*



*Mobilene is the standard cylinder-head packing*

No.76—Synthetic Rubber Bonded Asbestos Fiber Sheet—possesses high tensile strength for high or low pressure and temperature service against hot oils, petroleum solvents, refrigerants such as Freon, animal and vegetable oils, carbon tetrachloride, etc. The material is also used extensively for gaskets on airplane engines. The long fiber asbestos, bonded with synthetic rubber, composition provides resiliency and resistance to liquids which are detrimental to natural rubber. Furnished in sheets 40"x42" and 36"x63", and thicknesses of  $\frac{1}{64}$ " to  $\frac{1}{8}$ ".

Asbestos Coated Cloth Sheet Packings (Styles No.95 and 96): The asbestos cloth is impregnated and coated on both sides with a special Neoprene compound, making it especially serviceable in the aircraft industry where a strong, durable, flameproof sealing material is required for structural fireproofing and insulation. Furnished  $\frac{1}{16}$ " and  $\frac{1}{8}$ " thick in 50-yard rolls, 36" wide. Style No.96 is reinforced with brass wire insertion to provide a sheet of greater strength.

Liberty Red Rubber Sheet Packing (Styles No.107 and 108): This red rubber sheet, made from a heat-resisting rubber compound, is designed for use against hot and cold water, air and medium or low-pressure steam up to 150 lb. Style No.107 (Plain), recommended for all general services, is furnished in rolls 36" wide,  $\frac{1}{32}$ " and up. Style No.108, wire-inserted for greater strength, is also supplied in rolls 36" wide,  $\frac{1}{16}$ " and up. Both styles furnished as cut gaskets in all standard and special sizes.

Rubber and Synthetic Rubber Sheet Packings (Styles No.104,105,109,110,111,112 and 115): The following sheet packings are designed to meet a wide



variety of conditions requiring a rubber or synthetic rubber sheet.

**No.104—Synthetic Rubber for Oil and Gasoline—** For use against oil and petroleum solvents such as gasoline (not resistant to benzol, carbon tetrachloride and similar solvents). It is also well adapted to service against such gases as propane, butane, hydrogen, etc. No.104 has good resistance to abrasion and excellent tensile strength. Furnished in widths of 36" and in thicknesses of  $\frac{1}{16}$ " and up.

**No.105—Diaphragm Sheet for Oil and Gasoline—** Similar to No.104 except it is duck-inserted to provide the additional strength for diaphragm service. Furnished 36" wide in  $\frac{1}{32}$ " thickness and 46" wide in heavier thicknesses.

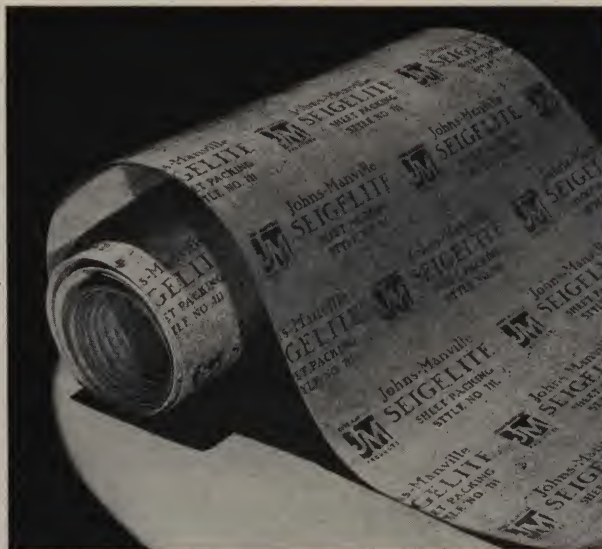
**No.109—For Hydraulic Service—Cloth-inserted (C.I.) rubber sheet for low-pressure cold water service,** this packing retains its resiliency and pliability in service. Furnished in 36"-wide rolls in thicknesses of  $\frac{1}{16}$ " and up.

**No.110—For Hydraulic Service—Similar to No.109** except it is made with cloth on one side (C.O.S.) instead of cloth-inserted. Also recommended for l-p cold water service. Furnished in 36"-wide rolls and thicknesses,  $\frac{1}{16}$ " and up.

**No.111—For Hydraulic Service—Same as No.110** except it has cloth on both sides (C.B.S.). Furnished in 36"-wide rolls,  $\frac{1}{16}$ " and up.

**No.112—Black Oil Proof—A dependable black rubber compound packing designed to resist oil.** However, it will not last quite as long in most oil or gasoline services as the newer synthetic rubber sheets (Styles No.104 and 105). In 36"-wide rolls,  $\frac{1}{16}$ " and up.

**No.115—Diaphragm Sheet—A duck-inserted rubber sheet especially designed for making diaphragms on damper regulators, reducing valves and similar equipment.** Furnished  $\frac{1}{16}$ " and up, in 46"-wide rolls.



*Seigelite is approved by Underwriters' Laboratories, Inc., for use against hazardous liquids*

**Seigelite Sheet Packing (Style No.711) :** A strong, dense, plant fiber packing designed for use against gasoline, benzine, oil, greases, and hot or cold water on all types of flanges and parallel surfaces. Not recommended where temperatures exceed 250 F, or for alternate wet and dry conditions. Approved by the Underwriters' Laboratories, Inc., for use against hazardous liquids. When immersed in liquids, Seigelite becomes extremely tough, resembling rawhide. Because of its tensile strength, it is much more satisfactory for hydraulic service than either rubber or cloth-inserted rubber sheets. Its density and resiliency allow it to be used in minimum thickness. The plant fibers are thoroughly impregnated with a preserving compound. No rubber or rubber substitutes are used which are soluble in gasoline or oil. Furnished in thicknesses of 0.01",  $\frac{1}{64}$ ", 0.02",  $\frac{1}{32}$ " and  $\frac{1}{16}$ ", in rolls 36" or 48" wide by 25 or 50 yards long. Thicknesses,  $\frac{1}{8}$ " and up, in sheets 36"x48" only. Also supplied as cut gaskets.



## Gaskets and Groove Packings

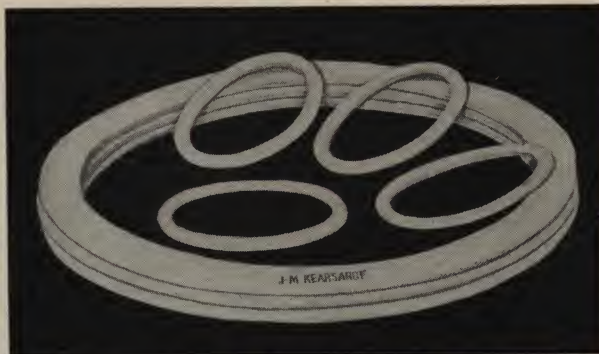
**Kearsarge Gaskets (Styles No.116,118 and 136):** These dependable gaskets, for sealing boiler manholes, handholes and tube plates, are of asbesto-metallic construction.

**No.116—Handhole and Manhole Gaskets—**Made by folding and forming to the proper size and shape, plies of strong, durable, wire-inserted asbestos cloth treated with a rubber heat-resisting compound. The edges of the folds are on the inner side, leaving an unbroken rounded shoulder on the outer side where the gasket is exposed to pressure. The gaskets are furnished in the standard oval shape, but other shapes supplied on order. Average inside diameters of standard handhole gaskets are from 3" to 6"; standard manhole gaskets, 6" to 18". Larger and smaller sizes are also available. Minimum flange width is  $\frac{3}{8}$ ". Thickness is approximately  $\frac{1}{16}$ " per ply of fabric. Best results are generally obtained by using gaskets three or four plies thick. When ordering, specify inside diameter (both dimensions on oval gaskets), width of flange and number of plies desired. For shapes other than round or oval, submit template or drawing and specify thickness.

**No.118—Tube Plate Gaskets—**Made seamless and without a joint from the same treated asbesto-metallic cloth as Style No.116. In ordering, specify size desired and make of boiler.

**No.136—Handhole and Manhole Gaskets—**For service against oil, gasoline, kerosene and other rubber solvents. Made the same as Style No.116 except for the synthetic rubber compound to resist the action of gasoline and similar fluids. Furnished same as No.116.

**Style No.60 Flange Gaskets:** Cut from J-M Service Sheet, No.60 Gaskets can be used under virtually all conditions where a non-metallic gasket is suitable. They are recommended for service against superheated or saturated steam, air, gas, hot or cold water, oil,



*Kearsarge Gaskets, of asbesto-metallic construction, have a wide reputation for dependable performance*

ammonia and some acids and alkalis. No.60 does not deteriorate with age and can be carried in storage indefinitely. Available in thicknesses of  $\frac{1}{64}$ ",  $\frac{1}{32}$ ",  $\frac{1}{16}$ " and  $\frac{1}{8}$ " for both standard and extra heavy flanges. They are furnished graphited on one or both sides, or plain, as required.

**Cut Gaskets:** Factory-cut gaskets are an economical investment when reasonably large quantities of the same size gaskets are purchased. They eliminate the time, trouble and scrap material involved when plant men must cut their own gaskets from sheet stock, Johns-Manville's well-equipped gasket department makes it possible to produce perfectly cut gaskets for every requirement. J-M Cut Gaskets are cut from every style of J-M Sheet Packing and in all the thicknesses in which the sheets from which they are cut are made. They are used for the same service conditions as their corresponding sheet packings (*Styles No.50,60,61,70, 71,76,83,84,95,96,98,100,101,104,105,107,108,109,110, 111,112,115,117,219 and 711*).

Gaskets can also be cut from asbestos paper, asbestos millboard, felt paper, manila tag paper, manila rope paper, strawboard, chipboard, fish paper, blotting paper, varnished cloth, etc.

When ordering J-M Cut Gaskets in special shapes, submit a blueprint or template with the order.

**Spirotallic Gaskets (Styles No.911,912,913 and 914):** A metal-asbestos gasket made of interlocked plies of preformed metal, cushioned with asbestos strip spirally wound. When compressed in service, the central spring-like corrugation of the metal strip is held under constant tension, compensating for expansion and contraction due to frequent and extreme changes of temperature. This action creates and maintains a



*Factory-cut gaskets are an economical investment*



perfect seal. Spirotallic gaskets have great mechanical strength and resilience unequalled by any other metallic gasket construction. They are highly resistant to corrosion and extreme temperatures, and are readily compressible with relatively light bolting. Tight seals are made and maintained economically, and their rugged construction frequently makes it possible to re-use them a number of times.

No.911—Recommended as a general purpose gasket for standard or special flanges, valve bonnets, etc. Made in circular, oval or irregular shapes.

No.912—Used where a centering device is required to position the gasket concentric with the flange contact face. The light but rigid centering device also acts as a reinforcing ring designed to allow proper radial expansion under compression.

No.913—This style consists of a Spirotallic Gasket assembled with a  $\frac{1}{8}$ "-thick soft steel combination centering guide and compression limiting gage. The thick guide tends to prevent damage of the gasket by over-stressing.

No.914—Designed for practically all handhole, tube cap and manhole covers for standard makes of boilers, economizers and superheaters. It is essential when ordering to give make of boiler, actual shape, inside dimensions and over-all gasket width. For non-standard sizes, a template should be provided.

**Goetze Metal-Asbestos Gaskets:** J-M Goetze Gaskets are fabricated from any metal suitable for the particular conditions involved, in any practical size and shape—from tiny gaskets a fraction of an inch in diameter and weighing but a fraction of an ounce, to gaskets as large as 34 feet in diameter and weighing 1500 lb. The most important variables which influence gasket selection are temperatures and the corrosive nature of the application. Non-metallic gaskets and those incor-



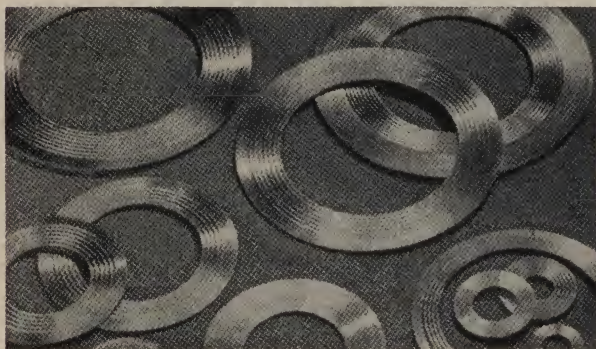
*Spirotallic is a durable, resilient, corrosion-resistant gasket for high-temperature service*

porating the low melting-point metals are generally limited to temperatures below 250F. Semi-metallic gaskets, made of asbestos, partially or completely clad with metal, may be used up to 850F. Above 850F, only all-metal gaskets are satisfactory. The corrosive nature of the confined fluid may limit the choice of gasket material and thus have an important bearing on the gasket construction and hardness. Typical of the many standard Goetze styles are No.926 and No.910.

Style No.926—Made with an asbestos filler completely enclosed in a corrugated metal jacket, this style is for general flange service. It is extensively used in chemical plants, power stations, oil refineries, etc., for severe service conditions and temperatures to 850F.

Style No.910—Constructed of deeply corrugated metal with twisted asbestos cord cemented into the corrugations on both faces, it requires relatively little bolt pressure to attain a tight seal. Conforms readily to rough or warped flange surfaces, and a protective metallic coating prevents sticking to flanges and increases resistance to moisture and corrosion. For temperatures to 850F and pressures to 600 psi. Not recommended for hot oil or vacuum lines.

**Tubular Gasketing (Styles No.124 and 125):** An efficient emergency gasketing that can be used whenever a gasket of round cross-section is desired. Style No.124 (Kearsarge) is made of strong, durable asbesto-metallic fabric treated with a heat-resisting rubber compound and rolled into round cross-section with a hollow center. For use against steam, air, gas and a wide variety of other general service conditions. No.125 (Liberty Red Rubber) is designed for use against water, air, medium and l-p steam to 150F.



*For general flange service, Goetze Gaskets provide a tight, efficient, long-lasting seal*



Groove or Door Packing (Styles No.C-17,C-176, C-177,C-216,C-790,C-866,C-872,128 and 129) : A complete coverage of packings for use on all types of doors, converter bottoms and other equipment where packing is applied in groove or slot.

C-17, For Furnace Doors, is made of twisted asbestos core, over which are braided jackets of copper wire-inserted asbestos yarns and finished with an open mesh braided copper wire jacket. For use where excessive wear occurs, such as where the door is opened and closed frequently. Furnished in square cross-section,  $\frac{3}{8}$ " and up.

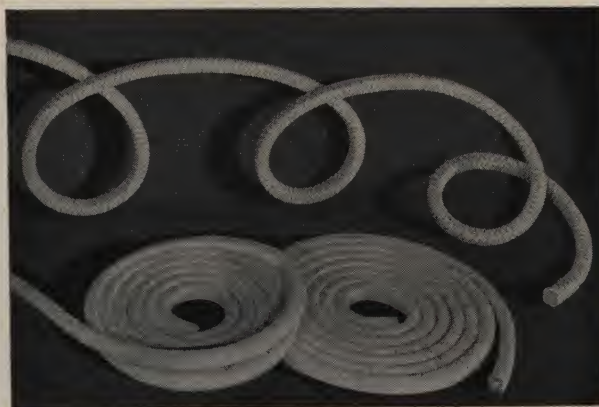
C-176, For Converter Bottoms, has unusual mechanical strength and high heat resistance and retains its shape when pounded into place in the groove. Furnished in square cross-section of rubber-frictioned asbestos cloth, without wire, wound around a core of asbestos rope, in size  $\frac{1}{4}$ " and up.

C-177, For Converter Bottoms, is the same as C-176 except the asbestos cloth is wire-inserted. Furnished in square cross-section,  $\frac{1}{4}$ " and up.

C-216, For Water Gas Generator Doors, is a rugged packing designed to withstand repeated opening and sealing of the doors. Made of braided jackets of wire-inserted asbestos yarn, slightly impregnated with a rubber heat-resisting compound, over a core of asbestos rope. Furnished graphited in round or square cross-section (state which),  $\frac{1}{2}$ " and up.

C-790, For Miscellaneous Doors, is for use on hot blast stove clean-out doors, boiler explosion doors, etc. Made of braided jacket-over-jacket from copper wire-inserted asbestos yarn. Furnished in round or square cross-section (state which),  $\frac{3}{8}$ " and up.

C-866, For General Service, is for all general services where a resilient, square material is desired. Made from a folded center block of asbestos cloth and a non-hard-



*Groove Packings are used on all types of doors, converter bottoms and other equipment*

ening rubber cushion, over which is wrapped a double wearing surface of asbestos cloth. Furnished  $\frac{1}{4}$ " and up.

C-872, For High Temperatures, is used for butterfly valves and similar apparatus. Made of pure asbestos yarn, wire-inserted, braided jacket-over-jacket and formed square. Furnished,  $\frac{3}{8}$ " and up.

No.128 and No.129, For Gas Purifier Boxes, are very rugged, unaffected by gas and will withstand the weight of the cover as well as the force exerted in tightening the hold-down screws. No.128 is made of plain asbestos cloth and No.129 of wire-inserted asbestos cloth. In both styles the cloth is folded back and forth into the required size and covered with a jacket of the same material. A heat-resisting compound is used on the center block but the covering jacket is untreated. Furnished square or rectangular. Minimum width or thickness is  $\frac{1}{2}$ ". When ordering, specify width, thickness and on which side the cover will rest.

**Tadpole Gasketing Tape (Style No.123) :** Designed for use as a door gasket where a groove is not provided, this tape provides a tight seal with a minimum pressure for service on oven doors, sterilizers, laboratory apparatus, safes, vaults, plenum chambers, air-conditioning equipment, dust collectors, textile dryers and dry kilns, as well as for hinged tank covers, cooking kettles, kiers, etc. Suitable for use against steam, air, water and gas. Special tape for extremely high temperatures or use against mineral oils and petroleum solvents, is available on special order. The tape is made of asbestos cloth wrapped over a core of asbestos wick or rope, depending upon the size and degree of softness required. The core forms a bulb or head to provide a cushion upon which the door or cover closes. Furnished in standard and special sizes,



*Tadpole Gasketing Tape provides an effective, tight seal without heavy pressure*



in coils of 50 ft. In ordering special sizes the bulb section should never be less than  $\frac{3}{8}$ " and the total width, including bulb section and flange, not less than  $\frac{3}{4}$ ". Standard sizes range from  $\frac{3}{8}$ "x $1\frac{3}{8}$ " to  $\frac{5}{8}$ "x $1\frac{3}{4}$ ".

**Tadpole Firewall Seals** (Styles No.3562,3496, 3554,3602,135,135-S, and 3472): These seals were specially developed, with cores of Inconel mesh or synthetic rubber, for resistance to flame or continuous high temperatures such as air-flow seals in jet engines and as firewall seals on combustion section bulkheads, engine mounting rings, turbine flanges, and along tail pipes.

No.3562—Constructed of Inconel mesh core, covered by Grade "AAA" asbestos cloth with Inconel wire insertion, coated with flameproof neoprene on the outside and stitched with asbestos.

No.3496—Inconel mesh core covered with plain "Underwriters'" Grade asbestos cloth, coated on both sides and cemented with flameproof neoprene.

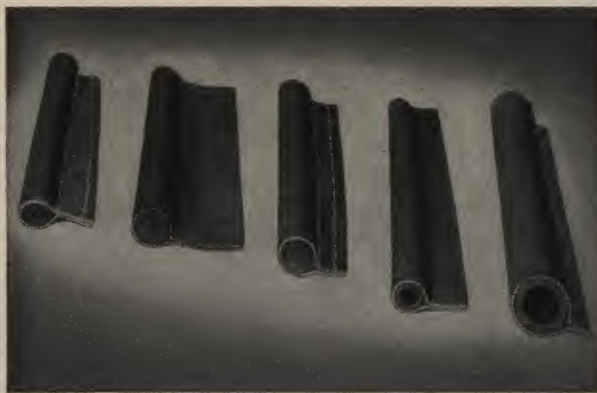
No.3554—Inconel mesh core covered with Grade "AAA" asbestos cloth, coated on outside with flameproof neoprene and asbestos-stitched.

No.3602—made with a synthetic rubber core that resists heat hardening. Covered with Grade "AA" asbestos cloth, coated on both sides and cemented with flameproof neoprene.

No.135 and 135-S—Both have cores of flameproof neoprene tubing covered by Commercial Grade asbestos cloth, coated on both sides with flameproof neoprene. Style No.135 is cemented with flameproof neoprene; No.135-S is asbestos-stitched.



*Gasketing Tapes serve where cut or preformed gaskets are impractical*



*Tadpole Firewall Seals are especially developed for resistance to flame or continuous high temperatures*

No.3472—Similar in construction to Style No.135 but is covered with "Underwriters'" Grade asbestos cloth. Makes a softer seal.

Furnished—Bulb diameters are  $\frac{3}{8}$ " to 1" for all styles, except No.3472 ( $1\frac{1}{32}$ " to  $3\frac{1}{32}$ "). Tape widths are  $2\frac{1}{2}$ " maximum. Lengths as follows: 25-ft max for No.3562,3496, and 3554; for No.3602, 50 ft up to  $\frac{1}{2}$ " diam and 12 ft from  $\frac{5}{8}$ " up; No.135 and 135-S, 50 ft up to  $\frac{5}{8}$ " and 3 ft from  $1\frac{3}{16}$ " up; No.3472, 50 ft up to  $1\frac{9}{32}$ " and 3 ft from  $2\frac{5}{32}$ " up.

**Gasketing Tapes** (Styles No.120,119,121 and 122): These tapes are for all general gasketing services where cut or preformed gaskets are not practical.

No.120—Kearsarge Gasketing Tape—A high quality, general utility gasketing tape which can be used successfully against steam, air, water, ammonia, and acidulated, alkaline and other chemical solutions, as well as general service conditions. It is a suitably soft and resilient material particularly recommended for rough or irregularly shaped surfaces. Similar in construction to Kearsarge Gaskets. Supplied in coil form in widths  $\frac{1}{2}$ " and up, thicknesses  $\frac{1}{16}$ " and up. Owing to the folded type of construction, it cannot be supplied in widths less than twice the thickness.

No.119—For Gasoline, Oil, Etc.—Same as No.120 except it is treated with a synthetic rubber compound. Furnished the same as No.120.

No.121 and 122—Woven Asbestos—Are for use where a tape without rubber or other impregnant is desired. No.121 is made of wire-inserted long fiber asbestos yarn. No.122, slightly softer than No.121, is made of plain long-fiber asbestos yarn and contains no wire. Both styles are furnished unimpregnated in coil form in widths  $\frac{1}{2}$ " and up, thicknesses  $\frac{1}{16}$ " and up.



## Asbestos Wick, Rope and Cord Packings

Asbestos wick, rope and cord are essentially general utility or emergency packings. Their use is not confined to any specific service or set of conditions but depends more upon the resourcefulness and ingenuity of the user of this type of packing.

**Asbestos Wick:** This type is made by twisting one or more strands of pure or commercially pure asbestos roving or felted asbestos, with or without a small cotton yarn in the center, depending upon the particular style. All styles are furnished without lubrication or graphite. When desired, the individual strands comprising the wick may be untwisted and used separately. Or, when a larger size is required, two or more lengths may be twisted together to form any desired thickness. Styles No.4202,4199,4197 and 4198 are made from strands of pure felted asbestos twisted together. They have greater tensile strength than wick made from roving and are easier to handle without breaking.

No.4202—Three strands twisted together; each strand with a small cotton yarn through the center. This style is the strongest and most convenient available.

No.4199—Same as No.4202 except it consists of a single strand.

No.4197—A single, soft strand used primarily for sealing acid carboy stoppers and similar services.

No.4198—Same as No.4197 except it is twisted more tightly and has a harder finish.

**Asbestos Roving:** The styles in this group are made of either pure or commercially pure asbestos roving twisted together.

No.4195—Made of a single strand of commercially pure asbestos roving.

No.195—Made of several strands of commercially pure asbestos roving.

No.202—Same as No.195 except that the strands consist of pure asbestos roving.

No.199—Consists of a single strand of pure asbestos roving.

No.4193—Made of pure blue African asbestos roving for service against acid conditions.

Furnished: All styles of Asbestos Wick and Roving are furnished in 25 or 50-lb paper tubes or  $\frac{1}{4}$ ,  $\frac{1}{2}$  and 1-lb balls. Thicknesses ( $\frac{1}{4}$ " max) vary per style.

**Twisted Asbestos Rope:** Two types are supplied: one for packing, caulking and gasketing; the other for yarning bell and spigot joints to safeguard water supply systems against contamination. Twisted Asbestos



*Twisted Asbestos Ropes are pliable and adaptable*

Rope Packings are used for many services where a thicker material than Asbestos Wick is required. Such as: Caulking joints between furnace doors and brickwork; for expansion joints on boiler drums, furnace brickwork and blast furnace connections; and for packing explosion doors, gas generator doors, manhole covers, etc. All styles of Asbestos Rope consists of two or more strands of Asbestos Wick twisted tightly together to form a rope of any desired thickness. Twisted Asbestos Rope Packing is made in various types and grades of asbestos wick while only felted asbestos wick is used in Asbestos Yarning Rope. The styles of Asbestos Rope available are:

No.4200—For General Service—This is the strongest, most adaptable and widely used style. It is made of strands of pure felted asbestos wick.

No.4196—For Ordinary Conditions—Made of strands of commercially pure roving type asbestos wick.

No.200—For High Temperatures—Made of strands of pure roving type asbestos wick.

No.4194—For Acid Conditions—Made of strands of pure African asbestos wick.

No.4210—Plain Yarning Rope—A low cost material which will not support bacteria, composed of tightly twisted strands of pure felted asbestos. Strands can be separated and re-twisted to make other sizes.

No.4211—Rubber Coated Yarning Rope—Plain asbestos rope coated with rubber to "lay" surface fibers and increase firmness and shape retention for easier application. Strands can be separated and material added or removed.

No.4212—Copper Jacketed Yarning Rope—Plain asbestos rope covered by copper wire helically wound in



opposite directions to provide a harder, more compact yarning material of maximum strength. Strands cannot be separated.

Furnished: All styles of Asbestos Rope and Asbestos Yarning Rope are furnished in coils weighing 10, 25 and 50 lb. Thicknesses, depending upon individual styles, run  $\frac{3}{8}$ " through 1".

**Braided Asbestos Rope:** Having a more compact structure than twisted rope, Braided Asbestos Rope endures abrasion and rough usage over longer periods of time. Typical uses are as follows: groove packing for the covers of kiers and similar vessels, manhole covers and inspection doors; packing around coke oven door jambs and oven and flue cap doors; insulation on flexible or curved heated piping; filling for expansion joints in furnace brickwork; blow-off pipe protection in H.R.T. boilers; hot blast valve packing; and many similar locations requiring a dry, heat-resisting material which will endure rough usage. Some styles are made of commercially pure asbestos, and others made from pure asbestos.

No.566(round)—This most popular style is made by braiding one or two jackets, depending upon size, of commercially pure asbestos yarn over a core of commercially pure twisted asbestos rope. In sizes  $\frac{1}{8}$ " through  $\frac{3}{4}$ ", one braided jacket;  $\frac{7}{8}$ " and larger, two braided jackets.

No.787(square)—Same as No.566 except it is calendered, after braiding, to square cross-section. Furnished,  $\frac{3}{16}$ " and up.

No.702(round)—One of the firmest and strongest types of asbestos rope, is made of commercially pure asbestos yarn braided into jackets, one over the other. Sizes,  $\frac{1}{8}$ " and up.

No.733(square)—Same as No.702 but calendered to square cross-section, in sizes  $\frac{3}{16}$ " and up.

No.580(square)—Plaited square from commercially pure asbestos yarn for use where a soft, easily deformed, yet strong asbestos rope is required. Furnished,  $\frac{3}{16}$ " and up.

No.581(square)—Similar to No.580 except the strands are copper wire-inserted for added strength. Supplied  $\frac{3}{16}$ " and up.

No.857(round)—One or two jackets of pure asbestos yarn are braided over a core of twisted pure asbestos rope. Furnished with one jacket,  $\frac{1}{8}$ " through  $\frac{3}{4}$ ";  $\frac{7}{8}$ " and larger, two jackets.

No.869(square)—Same as No.857 but calendered to square cross-section, in sizes of  $\frac{3}{16}$ " and up.



*Twisted Asbestos Cord has a hard finish and great tensile strength*

No.788(round)—For high temperatures, it is made of jackets of pure asbestos yarn braided one over the other and furnished  $\frac{1}{8}$ " and up.

No.873(square)—Similar to No.788 except it is calendered to square cross-section.

Packaging: All Braided Asbestos Rope round styles are furnished in 10, 25 or 50-lb coils; square styles in 10, 25 or 50-lb reels.

**Twisted Asbestos Cord (Styles No.285 and 274) :** Particularly recommended for suspending small objects in contact with flame and for string packing of small valve stems, Twisted Asbestos Cord has a smooth, hard finish and is stronger and more durable than braided or twisted rope. Especially serviceable in glass and chemical works, laboratories, plating works and wherever it is necessary to suspend metals, retorts, crucibles, etc., in contact with flame, heat, caustic solutions or weak acids. Also used for packing small valve stems.

No.285—Strands of strong 1, 2 or 3-ply asbestos yarn are twisted into a cord of the required diameter and treated with a suitable dressing to prevent raveling and to provide a smooth, hard finish. Furnished  $\frac{1}{16}$ " and up.

No.274—Similar to No.285 except that it is made of heavier asbestos yarns and is, therefore, lower in cost. Supplied  $\frac{1}{16}$ " and up.

Packaging: Both styles are furnished in 1 and 5-lb paper tubes;  $\frac{1}{4}$ ,  $\frac{1}{2}$  and 1-lb balls; or 5, 10, 25 and 50-lb spools.



# Johns-Manville Packing Recommendations

Johns-Manville Packings have been developed to meet all types of industrial packing requirements. Coupled with their high quality and efficiency is the prompt service afforded by more than 400 convenient distribution points.

In buying packing, it is well to keep in mind that coil and spiral are the most economical for maintenance purposes when the desired style is furnished in those forms. Rings to fit many different stuffing boxes can be cut from the same coil or spiral, thus reducing the

number of sizes that must be stocked and minimizing the danger of running out of one size while over-stocked with another.

The following recommendation tables are based on Johns-Manville's many years of packing experience and should prove helpful in selecting the right packing for every service. For special or unusual conditions, Johns-Manville has available engineers who will be glad to study the requirements and submit specific recommendations.

**THE FIRST MATERIAL LISTED** for each condition in the following table is the best recommendation for that service, except Sea Rings or Uneepac, which are the first recommendation for any service and condition under which they can be used.

**SEA RINGS and UNEEPAC** are automatic packings for reciprocating rods and plungers operating against steam, water, air, gas and oil, where the rod is in line, true and not scored.

SERVICE	<i>Rod, Outside-Packed Plunger and Valve Stem Packing</i>			
	<i>Reciprocating Rods and Plungers</i>		<i>Centrifugal and Oscillating Rods</i>	<i>Valve Stems</i>
	<i>Large Packing Space</i>	<i>Small Packing Space</i>		
Steam Over 500 F	167 Superheat 391 Flexible Metallic 395 Flexible Metallic	6 or 2 Rajah 398 High Temperature		13 or 14 Jewett 398 High Temperature 344 Metallic Mesh
Steam 350 to 500 F	166 Kearsarge 350 Flexible Metallic	6 or 2 Rajah 223 or 222 Mogul 255 or 257 Interlocked		2 or 6 Rajah 222 or 223 Mogul 10 Jewett
Steam Under 350 F	166 Kearsarge 171 Duro	223 or 222 Mogul 255 Interlocked 10 Jewett		222 or 223 Mogul 193 Mogul 10 Jewett
Water-Hot	271 Cross Diagonal 350 Flexible Metallic	223 or 222 Mogul 255 Interlocked 350 Flexible Metallic	7 or 11 Centripac 255 Interlocked 360 Flexible Metallic 350 Flexible Metallic 610 Plastic, With end rings of 360 Flexible Metallic	222 or 223 Mogul 193 Mogul
Water-Cold Over 500-lb pressure	190 or 245 Navalon 188 or 240 Flax 245 or 240 with end rings of 33 Universal, 182 Aqua or 280 Braided Copper	190 or 245 Navalon 188 or 240 Flax 245 or 240 with end rings of 33 Universal, 182 Aqua or 10 Jewett	11 Centripac 257 Interlocked 350 Flexible Metallic	10 Jewett 223 Mogul
Water-Cold 100 to 500-lb pressure	190 Navalon 188 or 189 Flax 610 Plastic with end rings of 350 Flexible Metallic	190 Navalon 188 or 189 Flax 223 or 222 Mogul 255 Interlocked	7 or 11 Centripac 255 Interlocked 360 Flexible Metallic 610 Plastic with end rings of 360 Flexible Metallic	222 or 223 Mogul 10 Jewett 350 Flexible Metallic
Water-Cold Under 100-lb pressure	190 Navalon 189 Flax	223 or 222 Mogul 255 Interlocked 190 Navalon 189 Flax	7 Centripac 255 Interlocked 360 Flexible Metallic 350 Flexible Metallic 610 Plastic with end rings of 360 Flexible Metallic	222 or 223 Mogul 193 Mogul 10 Jewett

## J-M PACKING RECOMMENDATIONS

June 1951 (Cancelling PK-18 through PK-20.1 dated August, 1943)

PK-20



## Recommendations for the use of Johns-Manville Packings—continued

SERVICE	<i>Rod, Outside-Packed Plunger and Valve Stem Packing</i>			
	<i>Reciprocating Rods and Plungers</i>		<i>Centrifugal and Oscillating Rods</i>	<i>Valve Stems</i>
	<i>Large Packing Space</i>	<i>Small Packing Space</i>		
Brine	190 Navalon 188 or 189 Flax 350 Flexible Metallic	190 Navalon 188 or 189 Flax 350 Flexible Metallic	7 Centripac 255 Interlocked 360 Flexible Metallic 350 Flexible Metallic 610 Plastic with end rings of 360 Flexible Metallic	222 or 223 Mogul 193 Mogul
Ammonia	172 Besta-Monia Combination of 172 with 223 Mogul	172 Besta Monia Combination of 172 with 223 Mogul	7 Centripac 255 Interlocked 352 Flexible Metallic	222 or 223 Mogul 193 Mogul
Acid—(Strong)	2011 Chempac 2017 Acid 640 Plastic with end rings of 379 Flexible Metallic (for Sulphurous or Sulphuric) 645 Plastic with end rings of 2017 (for acids that react with lead)	2011 Chempac 2017 Acid 640 Plastic with end rings of 379 Flexible Metallic (for Sulphurous or Sulphuric) 645 Plastic with end rings of 2017 (for acids that react with lead)	2012 Chempac 2018 Acid 640 Plastic with end rings of 379 Flexible Metallic (for Sulphurous or Sulphuric) 645 Plastic with end rings of 2018 (for acids that react with lead)	2012 Chempac 2017 Acid 2016 Acid
Acids—Weak	2011 Chempac 223 Mogul 255 Interlocked 350 Flexible Metallic 640 Plastic with end rings of 379 Flexible Metallic (for Sulphurous or Sulphuric) 645 Plastic with end rings of 2017 (for acids that react with lead)	2011 Chempac 223 Mogul 255 Interlocked 350 Flexible Metallic 640 Plastic with end rings of 379 Flexible Metallic (for Sulphurous or Sulphuric) 645 Plastic with end rings of 2017 (for acids that react with lead)	2012 Chempac 7 Centripac 255 Interlocked 360 Flexible Metallic 640 Plastic with end rings of 379 Flexible Metallic (for Sulphurous or Sulphuric) 645 Plastic with end rings of 2018 (for acids that react with lead)	2012 Chempac 222 or 223 Mogul
Air N. Y. & Westing-house Air Pumps	15-55 Combination Rings	222 or 223 Mogul 10 Jewett		
Air Compressors, Vacuum Pumps	15 Kearsarge 166 Kearsarge 55 Air Packing	222 or 223 Mogul 10 Jewett	7 Centripac 255 Interlocked 223 or 222 Mogul	222 or 223 Mogul 10 Jewett
Food Products, Alcohol, Caustic Weak Acids (To prevent discoloration)	2035 White Lubricated 630 Plastic with end rings of 2035 White Lubricated	2035 White Lubricated 630 Plastic with end rings of 2035 White Lubricated	2036 White Lubricated 630 Plastic with end rings of 2036 White Lubricated	2035 White Lubricated 630 Plastic with end rings of 2035 White Lubricated
Caustic (Strong)	2011 Chempac 2020 Caustic 2022 Caustic 254 Interlocked	2011 Chempac 2020 Caustic 2022 Caustic 254 Interlocked	2012 Chempac 2021 Caustic 2022 Caustic 630 Plastic with end rings of 2022 Caustic 254 Interlocked	2012 Chempac 2020 Caustic 2022 Caustic



## Recommendations for the use of Johns-Manville Packings—continued

SERVICE	<i>Rod, Outside-Packed Plunger and Valve Stem Packing</i>			
	<i>Reciprocating Rods and Plungers</i>		<i>Centrifugal and Oscillating Rods</i>	<i>Valve Stems</i>
	<i>Large Packing Space</i>	<i>Small Packing Space</i>		
Caustic (Weak)	2011 Chempac 2020 Caustic 223 Mogul 254 Interlocked	2011 Chempac 2020 Caustic 223 Mogul 254 Interlocked	2012 Chempac 2021 Caustic 7 Centripac 254 Interlocked 630 Plastic with end rings of 2022 Caustic	2012 Chempac 2020 Caustic 222 or 223 Mogul
Vegetable Oil	2035 White Lubricated 223 or 222 Mogul 255 Interlocked 10 Jewett	2035 White Lubricated 223 or 222 Mogul 255 Interlocked 10 Jewett	2036 White Lubricated 7 or 11 Centripac 255 Interlocked 223 or 222 Mogul 10 Jewett 350 Flexible Metallic 360 Flexible Metallic	2036 White Lubricated 222 or 223 Mogul 193 Mogul
Natural Gas Over 500-lb pressure	Sea Rings Uneepac 15 Kearsarge	15 Kearsarge 10 Jewett		
Natural Gas Under 500-lb pressure	15 Kearsarge 223 Mogul 10 Jewett	223 or 222 Mogul 10 Jewett		
Crude Oil over 350 F	270 Interlocked 789 Thermo 731 Rod	270 Interlocked 789 Thermo 731 Rod 2 or 6 Rajah	270 Interlocked 789 Thermo 395 Flexible Metallic	270 Interlocked 2 or 6 Rajah 395 Flexible Metallic
Crude Oil 100 to 350 F	10 Jewett 6 Rajah	10 Jewett 6 Rajah	7 Centripac 255 or 257 Interlocked 223 Mogul 350 Flexible Metallic	222 or 223 Mogul 10 Jewett
Crude Oil Under 100 F	10 Jewett 190 or 245 Navalon	10 Jewett 223 Mogul 255 Interlocked 190 or 245 Navalon	7 Centripac 255 Interlocked 360 Flexible Metallic 620 Plastic with end rings of 360 Flexible Metallic	222 or 223 Mogul 10 Jewett
Gasoline Distillates Butane Propane	323 Gasoline Rod 259 Interlocked 393 Flexible Metallic	323 Gasoline Rod 259 Interlocked 393 Flexible Metallic	604 Gasoline 18 Centripac 323 Gasoline Rod 393 Flexible Metallic 620 Plastic with end rings of 361 Flexible Metallic	323 Gasoline Rod 293 Gasoline Rod 604 Gasoline
Fuel and Lubri- cating Oils	223 Mogul 10 Jewett 255 Interlocked	223 Mogul 10 Jewett 255 Interlocked	7 Centripac 393 Flexible Metallic 620 Plastic with end rings of 393 or 7	223 Mogul 393 Flexible Metallic 620 Plastic with end rings of 393 or 7



## Recommendations for the use of Johns-Manville Packings—continued

SERVICE	<i>Rod, Outside-Packed Plunger and Valve Stem Packing</i>			
	<i>Reciprocating Rods and Plungers</i>		<i>Centrifugal and Oscillating Rods</i>	<i>Valve Stems</i>
	<i>Large Packing Space</i>	<i>Small Packing Space</i>		
Asphaltic and Heavy Oils 350 to 500 F	789 Thermo 10 Jewett 350 Flexible Metallic	789 Thermo 10 Jewett 350 Flexible Metallic	270 Interlocked 395 Flexible Metallic	10 Jewett
Asphaltic and Heavy Oils Under 350 F	10 Jewett 350 Flexible Metallic	10 Jewett 350 Flexible Metallic	270 Interlocked 395 Flexible Metallic	10 Jewett

SERVICE	<i>Inside-Packed Piston or Plunger Packing</i>
Cold and Hot Water, Brine, Oils, Some chemicals	33 Universal; 295 Light Weight Hydraulic 182 Aqua; 290 Square Hydraulic
Crude, Fuel, Mineral Seal, Lubricating, and Hydraulic Oils; Gasoline, Naphtha, Propane, Butane, Corrosive Hydrocarbons	34 Universal; Temperature not over 350 F
For All Services	80 Pump Cup Sets

SERVICE	<i>Sheet Packing</i>
General Service . . . . .	60, 61 (White Sheet), 50
Hot Oil . . . . .	76, 60, 70
Cold Oil, Gasoline, Benzine . . . . .	76, 711, 60
Solvents, Freon, Carbon Tetrachloride, Vegetable Oils . . . . .	76
Conditions requiring good electrical resistance . . . . .	71
Acid Service (general except hydrofluoric) . . . . .	83, 84
Water & Steam—Low pressures and temperatures . . . . .	107 Liberty
Rough or uneven flanges . . . . .	100 Kearsarge, 98 Kearsarge
Food Products (No discoloration) . . . . .	61
High temperature conditions on gas, air, etc. where rubber bonded sheets would be undesirable . . . . .	219 Felted Asbestos

SERVICE	<i>Gaskets</i>
All Conditions (Metallic Type) . . . . .	Goetze styles
General Service . . . . .	60, 61
Hot Oil . . . . .	70, 60, 61, 76, 136
Cold Oil, Gasoline, Naphtha, etc. . . . .	711, 76
Boiler or Tank Manholes and Handholes . . . . .	116 Kearsarge, 136 Kearsarge, J-M Spirotallic
Boiler Tube Plates: B&W, Heine, Edgemoor . . . . .	118 Kearsarge Jointless, 116 Kearsarge, J-M Spirotallic
Boiler Tube Plates: Other boilers . . . . .	116 Kearsarge, J-M Spirotallic
Emergency Repairs, Manholes . . . . .	124 Kearsarge Tubular
Acid Service . . . . .	83, 84, 117 Chempac
Caustic Service . . . . .	60, 117 Chempac
Solvents, Freon, Carbon Tetrachloride, Vegetable Oils . . . . .	76 Asbestos
Rough or uneven flanges . . . . .	116 or 100 Kearsarge, 98 Kearsarge
Odd or irregular shapes . . . . .	120, 119, or 122 Gasketing Tape
At elevated temperatures when rubber bonded sheets are undesirable . . . . .	219 Felted Asbestos



Recommendations for the use of Johns-Manville Packings—*continued*

SERVICE	Pump Valves	SERVICE	Expansion Joints
Hot Water—Maximum 300-lb pressure, 300 F	424	All Conditions	See Standard Rod and Plunger Recommendations
Cold Water—Pressure up to 200 lb	416		
Cold Water—200 to 400-lb pressure	415		
Condenser	420		
Oil, Ammonia, Syrups, etc.—	430		
Maximum 300-lb pressure; 300 F			
Hot or cold oil, gasoline, naphtha, etc., paraffin, hot or cold water, weak acids and weak alkalis. Limit 300 F, all pressures	300		

## Pulp and Paper Mill Packing Recommendations

SERVICE	Rod, Outside-Packed Plunger and Valve Stem Packing			
	Reciprocating Rods and Plungers		Centrifugal and Oscillating Rods	Valve Stems
	Large Packing Space	Small Packing Space		
<b>GROUND WOOD PULP</b>				
Pocket Grinder Cylinders	190 Navalon	190 Navalon		
Cold Water Rods	189 Flax	189 Flax		
	271 Cross Diagonal	271 Cross Diagonal		
Pistons	182 Aqua; 33 Universal; Moulded Packing Cups			
Pulp Pumps	253 Interlocked	253 Interlocked	253 Interlocked	
	19 Centripac	19 Centripac	19 Centripac	
	245 Navalon	245 Navalon	245 Navalon	
	240 or 181 Flax, no Graphite	240 or 181 Flax, no Graphite	240 or 181 Flax, no Graphite	
Hydraulic Pumps and Accumulators	245 Navalon	245 Navalon	245 Navalon	222 or 193 Mogul
	240 or 181 Flax	240 or 181 Flax	240 or 181 Flax	
	245 or 240 Flax, with end rings of 280 Flexible Metallic			
<b>SULPHITE PULP</b>				
Acid Pumps	2015 Acid	2015 Acid	640 Plastic with end rings of 379 Flexible Metallic	640 Plastic with end rings of 379 Flexible Metallic
Valves	640 Plastic with end rings of 379 Flexible Metallic	640 Plastic with end rings of 379 Flexible Metallic	2012 or 2018 Acid	2012 or 2018 Acid
Digester Pumps and Valves				
<b>SULPHATE and SODA PULP</b>				
Caustic Pumps and Valves	2021 or 2022 Caustic	2021 or 2022 Caustic	630 Plastic with end rings of 2022 Caustic	630 Plastic with end rings of 2022 Caustic
Digester Pumps and Valves	630 Plastic with end rings of 2022 Caustic	630 Plastic with end rings of 2022 Caustic	2021 or 2022 Caustic	2021 or 2022 Caustic
<b>RECOVERY PROCESS</b>				
Black Liquor Pumps	2021 or 2022 Caustic	2021 or 2022 Caustic	630 Plastic with end rings of 2021 Caustic	630 Plastic with end rings of 2021 Caustic
Evaporators	630 Plastic with end rings of 2022 Caustic	630 Plastic with end rings of 2022 Caustic		
Green and White Liquor Pumps and Valves				



## Pulp and Paper Mill Packing Recommendations—continued

SERVICE	<i>Rod, Outside-Packed Plunger and Valve Stem Packing</i>			
	<i>Reciprocating Rods and Plungers</i>		<i>Centrifugal and Oscillating Rods</i>	<i>Valve Stems</i>
	<i>Large Packing Space</i>	<i>Small Packing Space</i>		
<b>BLEACH ROOM</b> Bleach Liquor Pumps & Valves	2021 or 2022 Caustic 630 Plastic with end rings of 2022 Caustic	2021 or 2022 Caustic 630 Plastic with end rings of 2022 Caustic	2021 or 2022 Caustic 630 Plastic with end rings of 2021 Caustic	2021 or 2022 Caustic 630 Plastic with end rings of 2022 Caustic
Chlorine Pumps and Valves	2013 Chempac or 2018 Acid 645 Plastic with end rings of 2018 Acid	2013 Chempac or 2018 Acid 645 Plastic with end rings of 2018 Acid	2013 Chempac or 2018 Acid 645 Plastic with end rings of 2018 Acid	2013 Chempac or 2018 Acid 645 Plastic
<b>MACHINE ROOM</b> White Water Stock Pumps	253 Interlocked 19 Centripac	253 Interlocked 19 Centripac	253 Interlocked 19 Centripac	253 Interlocked 19 Centripac
Jordans and Refiners Stock Chests			253 Interlocked 19 Centripac	253 Interlocked 19 Centripac

## Gas Manufacturing Plant Packing Recommendations

SERVICE	<i>Rod, Outside-Packed Plunger and Valve Stem Packing</i>			
	<i>Reciprocating Rods and Plungers</i>		<i>Centrifugal and Oscillating Rods</i>	<i>Valve Stems</i>
	<i>Large Packing Space</i>	<i>Small Packing Space</i>		
Warm Water— Seal Box and Scrubber	10 Jewett	10 Jewett	7 Centripac 360 Flexible Metallic	222 or 193 Mogul
Crude, Fuel and Gas Oil, Gas Tar, Oil & Tar, Oil & Tar Drips, Tar Water, Gas & Tar, Gas Exhauster Shafts	10 Jewett 360 Flexible Metallic	10 Jewett 360 Flexible Metallic	7 Centripac 360 Flexible Metallic	222 or 193 Mogul
Naphthalene	361 Flexible Metallic 323 Gasoline Rod	361 Flexible Metallic 323 Gasoline Rod	18 Centripac 361 Flexible Metallic 323 Gasoline Rod	18 Centripac 323 Gasoline Rod
Ammonia, Water and Ammonia, Tar & Ammonia	271 Cross Diagonal	271 Cross Diagonal	360 and 362 Flexible Metallic Combination	222 Mogul
Oil Splash Lubri- cated Engines	223 Mogul or 223 Mogul and 360 Flexible Metallic Combination			
Special Packing Conditions	Purifier Box Cover and Door Seals . . . . . 129 Groove Packing Hot Valves: Generator to Carburetor . . . . . 10 Jewett Generator Ash and Clunker Doors . . . . . 216 Generator Door, 566 or 787 Braided Asbestos Rope			
Hydraulic Valves	Style 401 Packing Cups on actuating pistons			

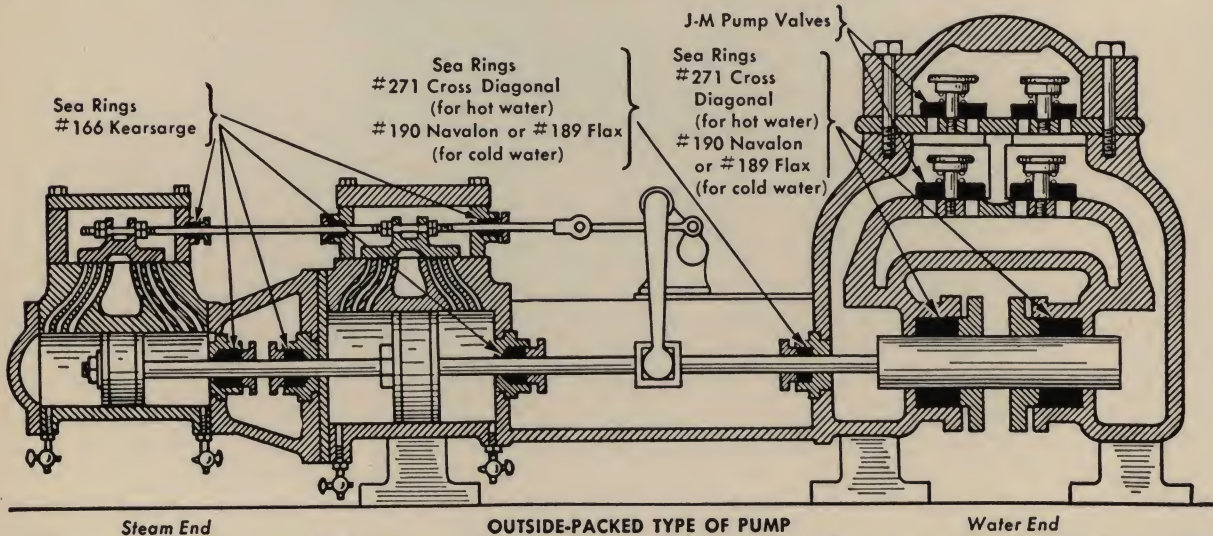
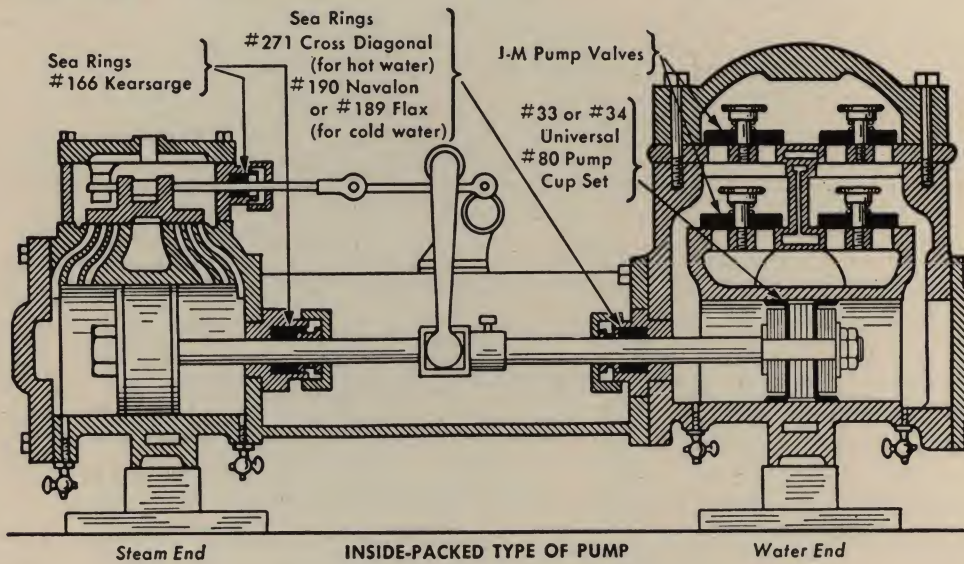
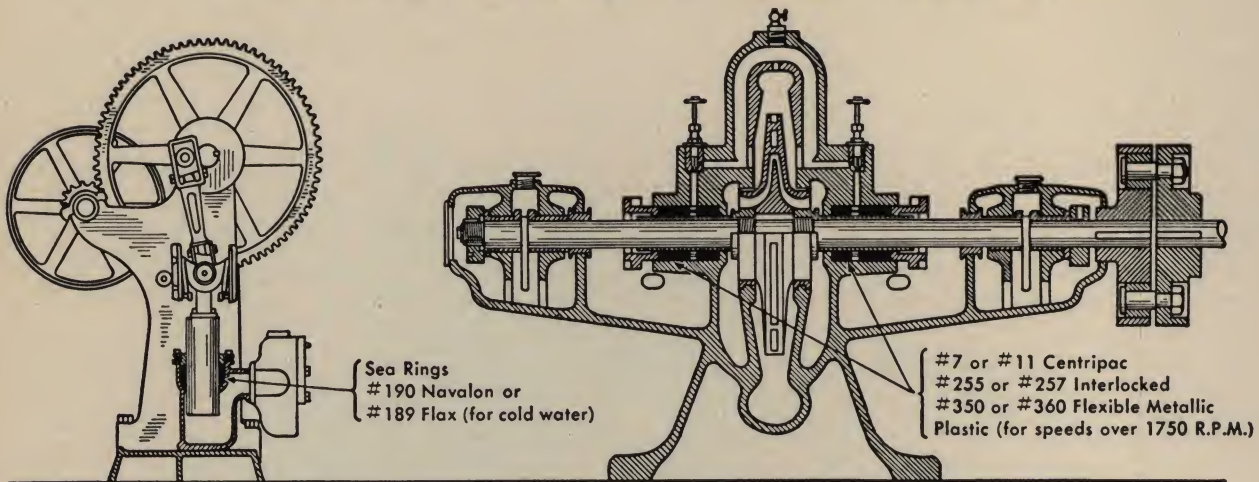


## Recommendations for the use of Johns-Manville Packings—continued

SERVICE	Pipe Line Station Special Packing Recommendations
Reciprocating Pipe Line Pumps	{ Sea Rings—special for pipe line work 190 or 245 Navalon 188, 240, 189 Flax or 181 W.P.H. Flax 7 Centripac, 255 Interlocked, 350 or 360 Flexible Metallic, 620 Plastic with end rings of flexible metallic or braided packing 271 Cross Diagonal 34 Universal, 295 Light Weight Hydraulic or 33 Universal
Centrifugal Pipe Line Pumps	
Cooling Pumps	
Suction Pumps	
SERVICE	Oil Refinery Special Packing Recommendations
Bubble Towers	733 or 873 Braided Rope
Scraper Rod	128 Groove Packing, 166 Kearsarge or 731 Rod
Tank Car Dome Gaskets	116 Kearsarge or 60 Service
Tank Car Outlet Cap Gaskets	60 Service or 711 Seigelite (wax-dipped)
Fire, Steam or Pressure Stills	60 Service or 219 Felted Asbestos
Filterhead (percolating filters)	787 Braided Asbestos Rope
SERVICE	Steel Mill Special Packing Recommendations
Hot Blast Stove cleanout doors, Boiler explosion doors, etc.	790 Groove Packing
Converter bottoms	177 Groove Packing
Butterfly valves	872 Groove Packing
Benzol, Tar, Wash Oil, Ammonia Liquor	Sea Rings
Service Water (Sheet packing)	60 Service or 107 Liberty
SERVICE	Lumber Special Packing Recommendations
Shot Guns	{ Top and bottom rings of 280 Braided Copper together with 166 Kearsarge, 32 Universal or 271 Cross Diagonal, or combinations of 166, 32 or 271
Feed Engines	
Kickers	
Niggers	
Donkey Engines	
Log Turners	
Loaders	
SERVICE	Miscellaneous Special Packing Recommendations
Steam Hammers } Accumulators }	{ Rods: 32 Universal, 271 Cross Diagonal, 166 Kearsarge, or combinations of 32, 271 and 166 Plungers: 33 Universal and 245 Navalon, or 240M Flax; or top and bottom rings of 33 Universal with 245 Navalon or 240 Flax Sea Rings 32 Universal 2035 or 2036 White Lubricated, 630 Plastic with end rings of 2035 White Lubricated 873 Pure Braided Asbestos Rope (no lubrication) Sea Rings 174, 174-T or 2013 Chempac 2011 and 2012 Chempac 13 Jewett, 398, 399 398, 399, 13 Jewett
Milk Homogenizers and Viscolizers	
Food Products	
Oxygen	
Ceramic Slip Pumps and Tunnel Kiln Pushers	
Chlorine Shipping Container Valves	
General Chemical Service	
Stainless Steel Valve Stems	
High Temperature Valve Stems	



## J-M Pump Packing Recommendations





## How To Get The Best Results From Packing

There are four main factors that influence the life and performance of packings in service. By giving careful attention to all these factors, the most satisfactory service will be assured.

**Quality of Packing Used:** The cost of materials in a repacking job is, in most cases, the smallest item of expense. Labor, lost production and general shut-down expense are the real items to consider. Therefore, in practically all cases, the highest quality packing is the cheapest in the long run. Cost per year, rather than cost per pound, is the best way of judging packing quality.

**The Right Style for the Condition:** Recommendations governing the selection of packings for a particular service or set of conditions are given on other pages. These recommendations are based on Johns-Manville's wide experience in the manufacture and installation of packings. Where there exists a special condition, not covered, a J-M packing engineer will be glad

to study plant requirements and submit detailed recommendations.

**Mechanical Condition or Equipment:** Scored, fluted, eroded, rusty, shouldered or bent rods, or rods running low or out of true, will shorten the life of any packing. Therefore, it is cheapest in the end to use only high quality rods and to see that they are properly maintained and cared for.

**Proper Installation and Maintenance:** Packings play an important role in the efficient operation of industrial equipment and should be maintained with the same care as is exercised with any other vital machine part. No packing, regardless of quality or characteristics, will operate with the highest degree of efficiency unless it is properly installed and cared for. The simple suggestions following have been found helpful in prolonging the life of packing in service and eliminating many common packing problems.

### Rod Packings

1. First make sure the correct *style* packing is used. It is advisable to store packings in their original containers for easy identification.
2. Measure stuffing box accurately and make sure the right size packing and the right diameter rings are used. On cold conditions, such as cold water and brine, rings should be cut to exact size as there is little expansion. On steam service, a slight clearance on the ends of the rings may be advisable. For hot conditions, such as hot water and ammonia, a greater clearance is generally allowed. Realize also that there will be greater expansion on rings of large diameter.
3. Remove all old packing and see that the stuffing box is clean before new packing is installed.
4. Seat each ring evenly in the stuffing box before the next ring is applied.
5. Apply plenty of lubrication, such as lubricating oil or grease and graphite, when installing packing, to help the packing work in.
6. Stagger or break the joints.
7. When the necessary number of rings have been installed, take up evenly on the gland with a wrench, to assure proper seating of the packing, then slacken off and take up only finger-tight. Be sure the gland is not cocked, but that it is even and exerting equal pressure all around.
8. It is often advisable to allow the box to leak slightly in the beginning to allow for expansion and proper seating. Packing that is too tight in the box will cause undue friction and wear out quickly. When packing against hot water, it may be necessary, due to expansion, to slack off on the gland from time to time until a balance is reached. On ammonia compressors, during the "heat" period, it is often necessary to slacken the gland after it has been tightened on the "freeze."
9. Metallic and semi-metallic packings are very sensitive to gland adjustments and should be used only on rods which are in good condition and perfect alignment. Lip-type packings are also sensitive to gland pressure, due to wedging of the lips when excessive gland pressure is applied.

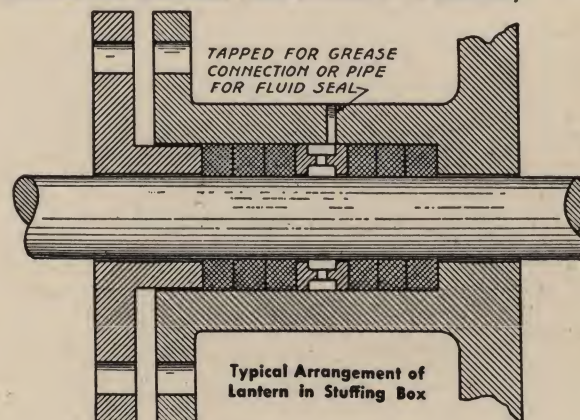
10. When equipment is to be laid up for several weeks or more, it is sometimes advisable to remove the packing and grease the rod in order to guard against the possibility of corrosion.

### Stuffing Boxes

Lubrication is just as important to packing as to a shaft running in a bearing. Johns-Manville applies scientific control over the type and quantity of lubrication incorporated in their packings. However, it is impossible to put sufficient lubrication into any packing to last throughout its normal operating life. Lack of lubrication has a tendency to increase friction and to make all packing lose its resiliency and become hard. The use of a lubricating seal ring, or lantern, has proved very effective in materially increasing the life of packings. Lantern rings are especially effective when used on rotating shafts.

Lanterns are also employed for cooling purposes or to seal against leakage of the liquids being pumped, such as expensive fluids or acids, and to prevent the infiltration of air through the stuffing box on the suction side of a centrifugal pump.

Oil, grease or water is supplied to the lantern ring, as indicated in the arrangement shown. Pump manufacturers generally furnish lantern rings as standard equipment on their pumps where service conditions indicate them to be necessary.





## Ring Packing Joints

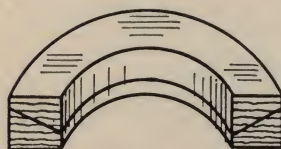
Regardless of the type of packing joint, the following simple recommendations should be adhered to:

The type of joint used in any rod, plunger or piston packing is a very important factor. In cutting rings on the job from spiral or coil packing, care should be taken to see that joints are carefully and accurately prepared, with proper allowance made for anticipated expansion of the packing in service.

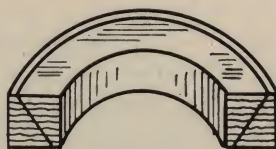
To prevent fraying of the ends when cutting rings from spiral or coil packings such as flax and braided, plaited or twisted asbestos, wrap a piece of tape around the packing where the joint is to be made and then cut through the center of the tape. This not only makes it easier to cut but also provides good square ends that stay square, without fraying, while being installed in the stuffing box.

The following is a description of the standard types of packing ring cuts and joints.

**Diagonal Cut:** The diagonal cut is supplied, when specified, on rings of the rubber and duck type. It is used extensively for rods or plungers which are worn or out of line, and for rods having considerable vibration or sway. The diagonal cut ring is frequently used in combination with plain rings.



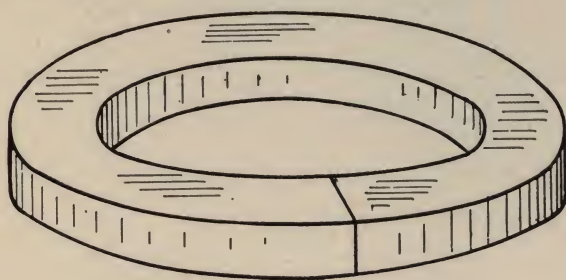
*Diagonal Cut*



*Sectional Cut*

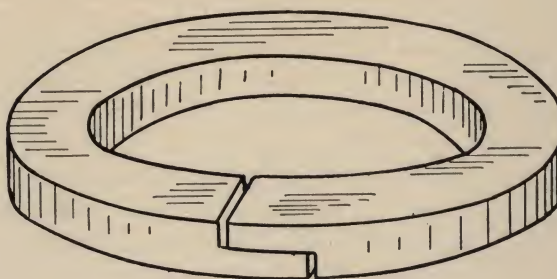
**Sectional Cut:** The sectional cut is supplied, when specified, on rings of the rubber and duck type. It is used principally in combination with plain rings for worn or scored plungers or rods. Sectional cut rubber and duck rings are extensively used on ammonia compressors.

**Butt or Square Joint:** The butt or square joint is the simplest type of cut. It is made by a straight knife cut through the body of the ring on one side at right angles to the flange width. With certain types of packings using this type of joint, care must be taken to allow for expansion in order to prevent jamming due to the swelling of the packing in service.



*Butt or Square Joint*

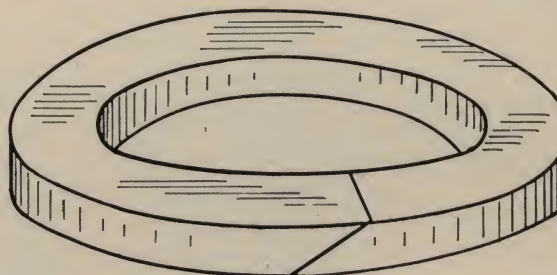
**Step Joint or Step Cut:** This joint is usually used on hydraulic packings for inside packed pistons where a jointed ring is required. The advantage of the step joint or step cut is that it provides for a considerable amount of expansion without losing the continuity of the ring periphery and consequent loss of efficiency through slippage of liquid past the rings. This advantageous effect is accomplished by a clearance left at each end of the tongues forming the top and bottom of the joint,



*Step Joint or Step Cut*

permitting the joint to open and close and still retain contact with the cylinder wall throughout its entire outside circumference.

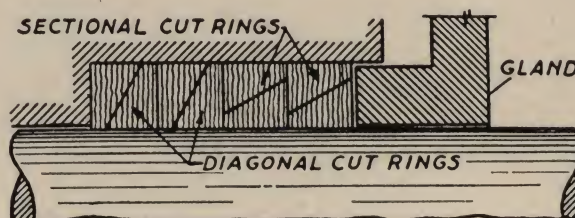
**Bevel or Skive Joint:** This type of joint is most commonly used on all types of rod and plunger packing. A slight advantage of the bevel or skive joint over the butt or square joint is that the bevel joint permits a certain amount of sliding action in the joint, thus absorbing a portion of the ring expansion due to the swelling encountered in some services.



*Bevel or Skive Joint*

## Installation of Cut Rings

To secure best results, installations of either diagonal or sectional cut rings should be made as follows:



*Installation of Cut Rings*

1. The outside section of ring, or that part of the divided ring which is concave, should be placed first in the stuffing box with the concave side of the ring facing the gland.
2. The inner section of the ring should then be installed and care taken to see that the outer and inner sections are concentric and properly nested.
3. The entire ring should then be firmly seated before installing the next ring.
4. Care should be taken to stagger all joints.



**How to get the Best Results from Packing (continued)****J-M Packing Symbols**

For simplification, Johns-Manville uses but one style number for each different kind of packing, instead of a different number for coil, spiral and ring. The following symbols are used to identify the different forms in which J-M Packings are furnished:

- Prefix C— = Coil form  
 S— = Spiral form  
 R— = Ring form
- Suffix—SC = Sectional cut rings  
 —DC = Diagonal cut rings  
 —RH = Rock hard  
 —S = Solid rings (R-182, R-295 and R-290 furnished with step joint unless —S specified)  
 —C = Rings formed from coil (R-171, R-172, R-182, R-290 and R-295 furnished cut from slab unless —C specified)  
 —DD = Double dipped in lubrication, or more lubrication than standard

**Installation of Sea Rings**

A set of J-M Rings is usually composed of one header ring, several Sea Rings and one follower ring. (See tags attached to rings.) The number of Sea Rings used depends upon the depth of the stuffing box. They should be installed as follows:

1. Remove old packing and clean the stuffing-box.
2. First install header, so tagged, as arranged in set when received. See that it is pushed back so that all of it is seated against the bottom of the stuffing-box. Then install Sea Rings with lips toward the pressure and with the joints staggered. Be sure that the lip of each Sea Ring is properly seated against the preceding ring. After all Sea Rings are in, install follower ring, so tagged, last, as arranged in set when received.
3. Do not pull ends of rings straight apart to pass over rod. Separate them sideways as indicated.



The "Correct Way" to install



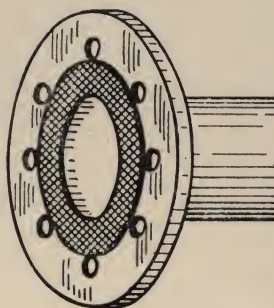
The "Incorrect Way" to install

4. Work the two ends of rings into the box first and then the remainder of the ring.
5. Never cut off ends or any part of rings. They are made to fit tight against inside of stuffing-box.
6. Only sufficient gland pressure must be used to prevent movement of the packing in the box. When installation is first made, take up gland nuts only finger-tight to allow Sea Rings to adjust themselves properly, during which time there will probably be a slight leakage. The gland nuts should be inspected to see that they are kept just tight enough to stop all leakage, as excessive gland pressure tends to distort the Sea Rings and impair their efficiency.

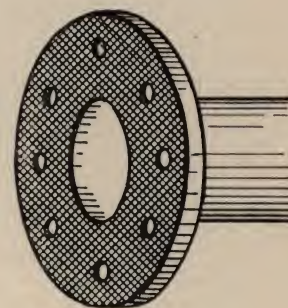
**Gasket Suggestions**

To assure the most satisfactory gasket service, the following installation suggestions should be observed:

1. Use a quality gasket, as the cost of the gasket is only a small part of the total cost. Also, be sure the style selected is recommended for the conditions against which it will be used.
2. See that the flanges are perfectly clean and true.
3. Use as thin a gasket as possible for the particular flange condition. Where flanges or surfaces are perfectly flat and smooth, a thin gasket is, as a rule, better than a thicker gasket. Where surfaces are rough or do not line up perfectly, a thicker gasket usually does a better job.
4. A ring cut gasket is generally preferable to a full flange gasket.



Ring-Cut Gasket



Full-Flange Gasket

5. See that the gasket is properly centered and does not project inside the flanges.
6. When it is desirable to graphite one or both surfaces of the gasket for easy removal, use a solution of graphite and water, with or without a small amount of glycerine. NEVER USE MINERAL OIL FOR APPLYING GRAPHITE, as it causes deterioration of gaskets containing rubber. This applies to all types of boiler manhole and hand hole gaskets, except metallic, as well as gaskets cut from rubber sheet packing. If the joint is to be permanent, it is better not to treat the gasket at all.
7. See that all bolts or studs are in good condition.
8. See that the flanges are pulled up evenly and tightly. Alternate from side to side in taking up bolts or studs to insure even pressure all around.



**CENTIGRADE AND FAHRENHEIT CONVERSION TABLE**

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
-40	-40.0	+10	+50.0	+150	+302	+350	+662	+550	+1022	+750	+1382	+950	+1742	+1300	+2372
-38	-36.4	11	51.8	155	311	355	671	555	1031	755	1391	955	1751	1310	2390
-36	-32.8	12	53.6	160	320	360	680	560	1040	760	1400	960	1760	1320	2408
-34	-29.2	13	55.4	165	329	365	689	565	1049	765	1409	965	1769	1330	2426
-32	-25.6	14	57.2	170	338	370	698	570	1058	770	1418	970	1778	1340	2444
-30	-22.0	15	59.0	175	347	375	707	575	1067	775	1427	975	1787	1350	2462
-28	-18.4	16	60.8	180	356	380	716	580	1076	780	1436	980	1796	1360	2480
-26	-14.8	17	62.6	185	365	385	725	585	1085	785	1445	985	1805	1370	2498
-24	-11.2	18	64.4	190	374	390	734	590	1094	790	1454	990	1814	1380	2516
-22	-7.6	19	66.2	195	383	395	743	595	1103	795	1463	995	1823	1390	2534
-20	-4.0	20	68.0	200	392	400	752	600	1112	800	1472	1000	1832	1400	2552
-19	-2.2	21	69.8	205	401	405	761	605	1121	805	1481	1010	1850	1410	2570
-18	-0.4	22	71.6	210	410	410	770	610	1130	810	1490	1020	1868	1420	2588
-17	+ 1.4	23	73.4	215	419	415	779	615	1139	815	1499	1030	1886	1430	2606
-16	+ 3.2	24	75.2	220	428	420	788	620	1148	820	1508	1040	1904	1440	2624
-15	5.0	25	77.0	225	437	425	797	625	1157	825	1517	1050	1922	1450	2642
-14	6.8	30	86.0	230	446	430	806	630	1166	830	1526	1060	1940	1460	2660
-13	8.6	35	95.0	235	455	435	815	635	1175	835	1535	1070	1958	1470	2678
-12	10.4	40	104.0	240	464	440	824	640	1184	840	1544	1080	1976	1480	2696
-11	12.2	45	113.0	245	473	445	833	645	1193	845	1553	1090	1994	1490	2714
-10	14.0	50	122.0	250	482	450	842	650	1202	850	1562	1100	2012	1500	2732
-9	15.8	55	131.0	255	491	455	851	655	1211	855	1571	1110	2030	1510	2750
-8	17.6	60	140.0	260	500	460	860	660	1220	860	1580	1120	2048	1520	2768
-7	19.4	65	149.0	265	509	465	869	665	1229	865	1589	1130	2066	1530	2786
-6	21.2	70	158.0	270	518	470	878	670	1238	870	1598	1140	2084	1540	2804
-5	23.0	75	167.0	275	527	475	887	675	1247	875	1607	1150	2102	1550	2822
-4	24.8	80	176.0	280	536	480	896	680	1256	880	1616	1160	2120	1560	2840
-3	26.6	85	185.0	285	545	485	905	685	1265	885	1625	1170	2138	1570	2858
-2	28.4	90	194.0	290	554	490	914	690	1274	890	1634	1180	2156	1580	2876
-1	30.2	95	203.0	295	563	495	923	695	1283	895	1643	1190	2174	1590	2894
0	32.0	100	212.0	300	572	500	932	700	1292	900	1652	1200	2192	1600	2912
+ 1	33.8	105	221.0	305	581	505	941	705	1301	905	1661	1210	2210	1650	3002
2	35.6	110	230.0	310	590	510	950	710	1310	910	1670	1220	2228	1700	3092
3	37.4	115	239.0	315	599	515	959	715	1319	915	1679	1230	2246	1750	3182
4	39.2	120	248.0	320	608	520	968	720	1328	920	1688	1240	2264	1800	3272
5	41.0	125	257.0	325	617	525	977	725	1337	925	1697	1250	2282	1850	3362
6	42.8	130	266.0	330	626	530	986	730	1346	930	1706	1260	2300	1900	3452
7	44.6	135	275.0	335	635	535	995	735	1355	935	1715	1270	2318	1950	3542
8	46.4	140	284.0	340	644	540	1004	740	1364	940	1724	1280	2336	2000	3632
9	48.2	145	293.0	345	653	545	1013	745	1373	945	1733	1290	2354	2050	3722

**METRIC CONVERSION TABLE**

Millimeters  $\times .03937 =$  inches.  
 Millimeters  $\div 25.4 =$  inches.  
 Centimeters  $\times .3937 =$  inches.  
 Centimeters  $\div 2.54 =$  inches.  
 Meters  $\times 39.37 =$  inches.  
 Meters  $\times 3.281 =$  feet.  
 Meters  $\times 1.094 =$  yards.  
 Kilometers  $\times .6214 =$  miles.  
 Kilometers  $\div 1.6093 =$  miles.  
 Kilometers  $\times 3281 =$  feet.  
 Square Centimeters  $\times .155 =$  sq inches.  
 Square Centimeters  $\div 6.452 =$  sq inches.  
 Square Meters  $\times 10.764 =$  sq feet.  
 Square Kilometers  $\times 247.1 =$  acres.  
 Hectare  $\times 2.471 =$  acres.  
 Cubic Centimeters  $\div 16.383 =$  cubic inches.  
 Cubic Centimeters  $\div 29.57 =$  fluid ounce (U.S.P.).

Cubic Meters  $\times 35.315 =$  cubic feet.  
 Cubic Meters  $\times 1.308 =$  cubic yards.  
 Cubic Meters  $\times 264.2 =$  liquid gallons (231 cubic inches).  
 Liters  $\times 61.02 =$  cu in.  
 Liters  $\times 33.8 =$  fluid ounces (U.S.P.).  
 Liters  $\times .2642 =$  liquid gallons (231 cu in.).  
 Liters  $\div 3.78 =$  liquid gallons (231 cu in.).  
 Liters  $\div 28.316 =$  cubic feet.  
 Hectoliters  $\times 3.531 =$  cubic feet.  
 Hectoliters  $\times 2.838 =$  bushels (2150.42 cu in.).  
 Hectoliters  $\times .131 =$  cubic yards.  
 Hectoliters  $\div 26.42 =$  liquid gallons (231 cu in.).  
 Grams  $\times 15.43 =$  grains.  
 Grams  $\div 981 =$  dynes.  
 Grams (water)  $\div 29.57 =$  fluid ounces.

Grams  $\div 28.35 =$  ounces avoirdupois.  
 Grams per cu. cent.  $\div 27.68 =$  lbs per cubic inch.  
 Joule  $\times .7376 =$  foot pounds.  
 Kilograms  $\times 2.205 =$  pounds.  
 Kilograms  $\times 35.3 =$  oz. avoirdupois.  
 Kilograms  $\div 907.2 =$  tons (2,000 lbs.).  
 Kilograms per sq cent.  $\times 14.22 =$  lbs per sq in.  
 Kilogram-meters  $\times 7.233 =$  foot lbs.  
 Kilogr. per Meter  $\times .672 =$  lbs per foot.  
 Kilogr. per Cu. Meter  $\times .062 =$  lbs per cubic foot.  
 Kilowatts  $\times 1.341 =$  Horse Power.  
 Watts  $\div 746 =$  Horse Power.  
 Watts  $\times .7376 =$  foot pounds per second.  
 Cheval vapeur  $\div .9863 =$  Horse Power.  
 (Centigrade  $\times 1.8$ )  $+ 32 =$  degrees Fahr.



## Table of Decimal Equivalents

Millimeters and Fractions of Millimeters

8ths, 16ths, 32nds, and 64ths of an Inch

$1/100 = .0003937''$			
mm. Inches	mm. Inches	mm. Inches	mm. Inches
$1/50 = .00079$	$39/50 = .03071$	27 = 1.06299	64 = 2.51968
$2/50 = .00157$	$40/50 = .03150$	28 = 1.10236	65 = 2.55905
$3/50 = .00236$	$41/50 = .03228$	29 = 1.14173	66 = 2.59842
$4/50 = .00315$	$42/50 = .03307$	30 = 1.18110	67 = 2.63779
$5/50 = .00394$	$43/50 = .03386$	31 = 1.22047	68 = 2.67716
$6/50 = .00472$	$44/50 = .03465$	32 = 1.25984	69 = 2.71653
$7/50 = .00551$	$45/50 = .03543$	33 = 1.29921	70 = 2.75590
$8/50 = .00630$	$46/50 = .03622$	34 = 1.33858	71 = 2.79527
$9/50 = .00709$	$47/50 = .03701$	35 = 1.37795	72 = 2.83464
$10/50 = .00787$	$48/50 = .03780$	36 = 1.41732	73 = 2.87401
$11/50 = .00866$	$49/50 = .03858$	37 = 1.45669	74 = 2.91338
$12/50 = .00945$	1 = .03937	38 = 1.49606	75 = 2.95275
$13/50 = .01024$	2 = .07874	39 = 1.53543	76 = 2.99212
$14/50 = .01102$	3 = .11811	40 = 1.57480	77 = 3.03149
$15/50 = .01181$	4 = .15748	41 = 1.61417	78 = 3.07086
$16/50 = .01260$	5 = .19685	42 = 1.65354	79 = 3.11023
$17/50 = .01339$	6 = .23622	43 = 1.69291	80 = 3.14960
$18/50 = .01417$	7 = .27559	44 = 1.73228	81 = 3.18897
$19/50 = .01496$	8 = .31496	45 = 1.77165	82 = 3.22834
$20/50 = .01575$	9 = .35433	46 = 1.81102	83 = 3.26771
$21/50 = .01654$	10 = .39370	47 = 1.85039	84 = 3.30708
$22/50 = .01732$	11 = .43307	48 = 1.88976	85 = 3.34645
$23/50 = .01811$	12 = .47244	49 = 1.92913	86 = 3.38582
$24/50 = .01890$	13 = .51181	50 = 1.96850	87 = 3.42519
$25/50 = .01969$	14 = .55118	51 = 2.00787	88 = 3.46456
$26/50 = .02047$	15 = .59055	52 = 2.04724	89 = 3.50393
$27/50 = .02126$	16 = .62992	53 = 2.08661	90 = 3.54330
$28/50 = .02205$	17 = .66929	54 = 2.12598	91 = 3.58267
$29/50 = .02283$	18 = .70866	55 = 2.16535	92 = 3.62204
$30/50 = .02362$	19 = .74803	56 = 2.20472	93 = 3.66141
$31/50 = .02441$	20 = .78740	57 = 2.24409	94 = 3.70078
$32/50 = .02520$	21 = .82677	58 = 2.28346	95 = 3.74015
$33/50 = .02598$	22 = .86614	59 = 2.32283	96 = 3.77952
$34/50 = .02677$	23 = .90551	60 = 2.36220	97 = 3.81889
$35/50 = .02756$	24 = .94488	61 = 2.40157	98 = 3.85826
$36/50 = .02835$	25 = .98425	62 = 2.44094	99 = 3.89763
$37/50 = .02913$	26 = 1.02362	63 = 2.48031	100 = 3.93700
$38/50 = .02992$			
10 mm. = 1 Centimeter = 0.3937 inches			
10 cm. = 1 Decimeter = 3.937 inches			
10 dm. = 1 Meter = 39.37 inches			
25.4 mm. = 1 English inch			

8ths	$5/32 = .15625$	$17/64 = .265625$
$1/8 = .125$	$7/32 = .21875$	$19/64 = .296875$
$1/4 = .250$	$9/32 = .28125$	$21/64 = .328125$
$3/8 = .375$	$11/32 = .34375$	$23/64 = .359375$
$1/2 = .500$	$13/32 = .40625$	$25/64 = .390625$
$5/8 = .625$	$15/32 = .46875$	$27/64 = .421875$
$3/4 = .750$	$17/32 = .53125$	$29/64 = .453125$
$7/8 = .875$	$19/32 = .59375$	$31/64 = .484375$
	$21/32 = .65625$	$33/64 = .515625$
	$23/32 = .71875$	$35/64 = .546875$
16ths	$25/32 = .78125$	$37/64 = .578125$
$1/16 = .0625$	$27/32 = .84375$	$39/64 = .609375$
$3/16 = .1875$	$29/32 = .90625$	$41/64 = .640625$
$5/16 = .3125$	$31/32 = .96875$	$43/64 = .671875$
$7/16 = .4375$	64ths	$45/64 = .703125$
$9/16 = .5625$	$1/64 = .015625$	$47/64 = .734375$
$11/16 = .6875$	$3/64 = .046875$	$49/64 = .765625$
$13/16 = .8125$	$5/64 = .078125$	$51/64 = .796875$
$15/16 = .9375$	$7/64 = .109375$	$53/64 = .828125$
32ds	$9/64 = .140625$	$55/64 = .859375$
$1/32 = .03125$	$11/64 = .171875$	$57/64 = .890625$
$3/32 = .09375$	$13/64 = .203125$	$59/64 = .921875$
	$15/64 = .234375$	$61/64 = .953125$
		$63/64 = .984375$

## Circumferences and Areas of Circles

Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area
$1/2$	.0981	.00076	3	9.424	7.068	7	21.99	38.484	11	34.55	95.033	15	47.12	176.71	19	59.69	283.52
$1/4$	.1963	.00306	$3/4$	9.817	7.669	$7/8$	22.38	39.871	$1 1/4$	34.95	97.205	$1 1/2$	47.51	179.67	$1 3/4$	60.08	287.27
$3/8$	.2926	.01227	1	10.21	8.295	$1 1/8$	22.77	41.282	$1 1/2$	35.34	99.402	$1 3/4$	47.90	182.72	$2$	60.47	291.03
$1/2$	.3890	.02761	$1 1/4$	10.60	8.946	$1 1/4$	23.16	42.718	$1 3/4$	35.73	101.62	$2$	48.30	185.66	$2 1/4$	60.86	294.83
$3/4$	.4854	.04908	$1 1/2$	10.99	9.621	$1 1/2$	23.56	44.178	$2$	36.12	103.86	$2 1/4$	48.69	188.69	$2 1/2$	61.26	298.64
$1$	.5817	.07669	$1 3/4$	11.38	10.320	$1 3/4$	23.95	45.663	$2 1/4$	36.52	106.13	$2 1/2$	49.08	191.74	$2 3/4$	61.65	302.48
$1 1/4$	.6780	.1104	2	11.78	11.044	2	24.34	47.173	$2 3/4$	36.91	108.43	$3$	49.48	194.82	$3 1/4$	62.04	306.35
$1 1/2$	.7743	.1503	$2 1/4$	12.17	11.793	$2 1/4$	24.74	48.707	$3 1/4$	37.30	110.75	$3 1/2$	49.87	197.73	$3 3/4$	62.43	310.24
$1 3/4$	.8706	.1963	3	12.56	12.566	3	25.13	50.265	$3 3/4$	37.69	113.09	$4$	50.26	201.06	$4 1/4$	62.83	314.16
2	.9669	.2485	$3 1/4$	12.95	13.364	$3 1/4$	25.52	51.848	$4 1/4$	38.09	115.46	$4 1/2$	50.65	204.21	$4 3/4$	63.22	318.09
$2 1/4$	1.0632	.3097	$3 1/2$	13.35	14.186	$3 1/2$	25.91	53.456	$4 3/4$	38.48	117.85	$4 3/4$	51.05	207.39	$5$	63.61	322.06
$2 1/2$	1.1595	.3712	$3 3/4$	13.74	15.033	$3 3/4$	26.31	55.088	$5$	38.87	120.27	$5 1/4$	51.44	210.59	$5 1/2$	64.01	326.05
$2 3/4$	1.2558	.4417	4	14.13	15.904	$4$	26.70	56.745	$5 1/4$	39.27	122.71	$5 1/2$	51.83	213.82	$5 3/4$	64.40	330.06
3	1.3521	.5184	$4 1/4$	14.52	16.800	$4 1/4$	27.09	58.426	$5 3/4$	39.66	125.18	$5 3/4$	52.22	217.07	$6$	64.79	334.10
$3 1/4$	1.4484	.6013	$4 1/2$	14.92	17.720	$4 1/2$	27.48	60.132	$6$	40.05	127.67	$6 1/4$	52.62	220.35	$6 1/2$	65.18	338.16
$3 1/2$	1.5447	.6902	$4 3/4$	15.31	18.665	$4 3/4$	27.88	61.862	$6 1/4$	40.44	130.19	$6 1/2$	53.01	223.65	$6 3/4$	65.58	342.25
$3 3/4$	1.6410	.7854	5	15.70	19.635	5	28.27	63.617	$6 3/4$	40.84	132.73	$6 3/4$	53.40	226.98	$7$	65.97	346.36
$4$	1.7373	.8940	$5 1/4$	16.10	20.629	$5 1/4$	28.66	65.396	$7$	41.23	135.29	$7 1/4$	53.79	230.33	$7 1/2$	66.36	350.49
$4 1/4$	1.8336	1.0076	$5 1/2$	16.49	21.647	$5 1/2$	29.05	67.200	$7 1/4$	41.62	137.88	$7 1/2$	54.19	233.70	$7 3/4$	66.75	354.65
$4 1/2$	1.9299	1.1261	$5 3/4$	16.88	22.690	$5 3/4$	29.45	69.029	$7 3/4$	42.01	140.50	$7 3/4$	54.58	237.10	$8$	67.15	358.84
$4 3/4$	2.0262	1.2496	6	17.27	23.758	$6$	29.84	70.882	$8$	42.41	143.13	$8 1/4$	54.97	240.52	$8 1/2$	67.54	363.05
$4 3/8$	2.1225	1.3731	$6 1/4$	17.67	24.850	$6 1/4$	30.23	72.759	$8 1/4$	42.80	145.80	$8 1/2$	55.37	243.97	$8 3/4$	67.93	367.28
$4 1/2$	2.2188	1.4966	$6 1/2$	18.06	25.967	$6 1/2$	30.63	74.662	$8 3/4$	43.19	148.48	$8 3/4$	55.76	247.45	$9$	68.32	371.54
$4 1/4$	2.3151	1.6201	$6 3/4$	18.45	27.108	$6 3/4$	31.02	76.588	$9$	43.58	151.20	$9 1/4$	56.16	250.94	$9 1/2$	68.72	375.82
$4 1/8$	2.4114	1.7436	7	18.84	28.274	7	31.41	78.539	$9 1/4$	43.98	153.93	$9 1/2$	56.54	254.46	$10$	69.11	380.13
$4 1/4$	2.5077	1.8671	$7 1/4$	19.24	29.464	$7 1/4$	31.80	80.515	$9 1/2$	44.37	156.69	$9 3/4$	56.94	258.01	$10 1/4$	69.50	384.46
$4 1/2$	2.6040	1.9906	$7 1/2$	19.63	30.679	$7 1/2$	32.20	82.516	$9 3/4$	44.76	159.48	$9 3/4$	57.33	261.58	$10 1/2$	69.90	388.82
$4 3/8$	2.7003	2.1141	$7 3/4$	20.02	31.919	$7 3/4$	32.59	84.540	$10$	45.16	162.29	$10 1/4$	57.72	265.18	$10 3/4$	70.29	393.20
$4 3/4$	2.7966	2.2376	$8$	20.42	33.183	$8$	32.98	86.590	$10 1/4$	45.55	165.13	$10 1/2$	58.11	268.80	$11$	70.68	397.60
$4 1/2$	2.8929	2.3611	$8 1/4$	20.81	34.471	$8 1/4$	33.37	88.664	$10 1/2$	45.94	167.98	$10 3/4$	58.50	272.44	$11 1/4$	71.07	402.03
$4 1/4$	2.9892	2.4846	$8 1/2$	21.20	35.784	$8 1/2$	33.77	90.762	$10 3/4$	46.33	170.87	$11$	58.90	276.11	$11 1/2$	71.47	406.49
$4 1/8$	3.0855	2.6081	$8 3/4$	21.57	37.122	$8 3/4$	34.16	92.885	$11 1/4$	46.73	173.78	$11 1/2$	59.29	279.81	$11 3/4$	71.86	410.97

(Continued)



## Circumferences and Areas of Circles—Continued

Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area																																																									
23	72.25 72.64 73.04 73.43 73.82 74.21 74.61 75.00	415.47 420.00 424.55 429.13 433.73 438.30 443.01 447.69	34	106.8 107.2 107.5 107.9 108.3 108.7 109.1 109.5	907.92 914.61 921.32 928.06 934.82 941.60 948.41 955.25	45	141.3 141.7 142.1 142.5 142.9 143.3 143.7 144.1	1590.4 1599.2 1608.1 1617.0 1625.9 1634.9 1643.8 1652.8	56	175.9 176.3 176.7 177.1 177.5 177.8 178.2 178.6	2463.0 2474.0 2485.0 2496.1 2507.1 2518.2 2529.4 2540.5	67	210.4 210.9 211.2 211.6 212.0 212.4 212.8 213.2	3525.6 3538.8 3552.0 3565.2 3578.4 3591.7 3605.0 3618.3	81	254.4 255.2 256.0 256.8	5153.0 5184.8 5216.8 5248.8	82	257.6 258.3 259.1 259.9	5281.0 5313.2 5345.6 5378.0	83	260.7 261.5 262.3 263.1	5410.6 5443.2 5476.0 5508.8	84	263.8 264.6 265.4 266.2	5541.7 5574.8 5607.9 5641.1	85	267.0 267.8 268.6 269.3	5674.5 5707.9 5741.4 5775.0	86	270.1 270.9 271.7 272.5	5808.8 5842.6 5876.5 5910.5	87	273.3 274.1 274.8 275.6	5944.6 5978.9 6013.2 6047.6	88	276.4 277.2 278.0 278.8	6082.1 6116.7 6151.4 6186.2	89	279.6 280.3 281.1 281.9	6221.1 6256.1 6291.2 6326.4	90	282.7 283.5 284.3 285.1	6361.7 6397.1 6432.6 6468.2	91	285.8 286.6 287.4 288.2	6503.8 6539.6 6575.3 6611.5	92	289.0 289.8 290.5 291.3	6647.6 6683.8 6720.0 6756.4	93	292.1 292.9 293.7 294.5	6792.9 6829.4 6866.1 6902.9	94	295.3 296.0 296.8 297.6	6939.7 6976.7 7013.8 7050.9	95	298.4 299.2 300.0 300.8	7088.2 7125.5 7163.0 7200.5	96	301.5 302.3 303.1 303.9	7238.2 7275.9 7313.8 7351.7	97	304.7 305.5 306.3 307.0	7389.8 7427.9 7466.2 7504.5	98	307.8 308.6 309.4 310.2	7542.9 7581.5 7620.1 7658.8	99	311.0 311.8 312.5 313.3	7697.7 7736.6 7775.6 7814.7	100	314.1 314.9 315.7 316.4	7853.9 7893.3 7932.7 7972.2











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## Refractory Products

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REFRACTORY PRODUCTS—INDEX  
June, 1950 (Cancelling sheet dated October, 1949)

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## J-M Refractory Products



*Applying 3X Blazecrete in a "heavy patching" repair job*

Many different refractory products are necessary to fulfill the diversity of present-day furnace requirements. Johns-Manville meets such needs with castables, hydraulic-setting refractories, cements (bonding mortars), ramming mixtures, gunning, patching materials, and light-weight aggregates. These products, used alone or in combination, assure longer life, reduced maintenance and lower installation costs.

### Castables Avoid Delay

Refractory linings of many types can be efficiently produced with J-M Castable Refractories either by casting, tamping in place, plaster coating, or gunning, to form a monolithic refractory construction.

Furnace door linings, burner blocks, baffle tile, header protector tile, furnace hearths, pipe linings, refractory covers, rivet-heating furnaces, crucible and similar types of furnaces, and special shapes of all kinds can be quickly and economically cast with J-M Castable Refractories. These castable refractories are furnished dry and, when mixed with water, can be placed as easily as ordinary concrete. The castable refractories and their temperature limits are as follows:

**3X Firecrete®:** A J-M castable refractory which supplements H. T. Firecrete in the higher temperature range to 3000 F. 3X Firecrete has negligible shrinkage and exceptionally high resistance to spalling.

**H. T. Firecrete:** Similar in character to Standard but composed of a higher heat-resistant base for use against temperatures up to 2800 F.

**Standard Firecrete:** A selected, gradated, calcined material adaptable to a wide range of industrial purposes for temperatures up to 2400 F.

**L.W. Firecrete:** For use where a material of light weight, low thermal conductivity and low heat storage is required; has a temperature limit of 2400 F.

**No. 20 Firecrete:** This latest Firecrete, similar to L.W. but lighter, has a temperature limit of 2000 F.

These castable refractories reduce the inventory of special shapes because any desired replacement can be made and placed in service within 24 hours after casting—a guard against costly shutdowns.

### Gunning Refractories

For gunning and slap-troweling applications only, J-M provides three types of monolithic, dry-hydraulic setting refractories: 3X Blazecrete® for service tem-



peratures to 3000 F, Standard Blazecrete to 2400 F, and L.W. Blazecrete to 2000 F. They are especially adaptable for gun application in building new and repairing old refractory linings.

### **Ramming Mixtures**

Dense homogeneous linings, which will resist the attack and abrasion of molten, non-ferrous metals, can be made by ramming in place with air hammers. For ramming mixtures, the following J-M Refractories are recommended: No.28, to 3100 F; No.30 and No.34, to 3000 and 3400 F, respectively.

### **Light-Weight Aggregates**

J-M Light-Weight Aggregates are used for insulating or refractory fills. They can also be used for making concretes by mixing with calcium aluminate cement. There are two aggregates available: JM-2000 and JM-2400. (The numbers indicate maximum temperatures.)

### **Cements Prevent Premature Failure**

In best furnace practice, J-M Cements are used to bond and protect the fire brick. They increase the life of a refractory structure by resisting temperature, disintegration and spalling under furnace conditions.

The bonding strength and other properties of J-M Refractories are such that the cements will not separate from the fire brick because of movement in the setting. J-M Cements do not break the bond by shrinking or swelling or by reaction with furnace ash, slags or gases.

Exposing the edges of brick to the action of flame and molten ash is the commonest cause of rapid deterioration. Use of the proper J-M Cement cuts down heat losses because open joints and cracks in the setting are eliminated. Well-bonded joints also protect insulation from the action of furnace gases and vapors. Likewise, a tight setting prevents unnecessary cold air from being drawn in through the walls where negative pressures are carried in the furnace.

Fire brick generally soften at a temperature of at least 500 F below their melting point. When a fire clay or inferior refractory cement is used, open joints or cracks in the setting hasten this action.

However, brickwork well-protected with J-M Refractory Cement will stand higher temperatures because the destructive heat has access only to one face of the brick. With heat contacting only a single surface, there is more even temperature gradient throughout the brick. This eliminates internal strain, thereby reducing the spalling caused by sudden temperature changes.

**Laying Brick:** For general conditions, Johns-Manville has found certain types of refractory cements especially suitable for laying firebrick.

Under "ready-mixed, air-setting cements" the following are recommended: Blakite® for temperatures to 3200 F; Hellite® for temperatures to 3000 F; No. 20, to 2700 F; No. 2986, to 3200 F; No. 1626 to 2600 F.

For "dry, heat-setting cements," No.31 and No.32 (to 3100 F) are recommended.

In addition to these cements, others of a more specialized nature and of different characteristics are available for use where required.

### **Wash-Coating Cuts Operating Costs**

Open joints and rough brick texture give clinkers a good hold, and in removing them, bricks are often pulled out unless they are strongly bonded. Clinkering, however, can be retarded by making surfaces as smooth as possible with wash-coating.

The erosive action of oil flame and the slagging of brick by molten ash are mitigated in a setting which has tightly sealed joints and the brick pores filled by a wash-coat. This protection also tends to prevent brick disintegration caused by the action of furnace gases.

For general wash-coating requirements, the following refractory cements are preferred: For a ready-mixed, airsetting wash-coat, Blakite, Hellite, No.20, or No.2986; and for a dry, heat-setting cement, No.32.

It is recommended that these refractory cements be thoroughly worked into the brick in thin grout consistency to prevent flaking.

### **Patching Lengthens Furnace Life**

Failure of eroded furnace walls can be retarded by removing the deteriorated sections and patching with the proper J-M Refractory. The following refractory cements will accommodate general industrial requirements: Blakite, Hellite or No. 26 for hot or cold shallow patching of worn brickwork; and 3X Blazecrete, Standard Blazecrete and L.W. Blazecrete with trowel or gun for heavy patching, especially where brickwork has spalled or eroded deeply.

### **Technical Control Assures Results**

Aided by the most modern testing apparatus, the staff of J-M Ceramic Engineers is continually making comprehensive studies of the physical and chemical properties of refractories. Effort is directed toward developing new J-M Refractories, raising existing standards and determining improved application methods.



## Summary of J-M Refractory Products

### Castables

**Standard Firecrete.** A dry, hydraulic-setting cement for casting or tamping special refractory shapes and monolithic linings. The selected, graded, calcined material will pass a 6-mesh screen, thus making it adaptable for linings or shapes as thin as 1". It is especially advantageous in casting door linings, burner rings, baffle tile, pipe linings, furnace bottoms, and monolithic furnaces. Standard Firecrete has practically no drying or firing shrinkage up to 2400 F.

**H.T. Firecrete.** Similar in properties and uses to Standard Firecrete but is composed of a higher resistant base which makes it applicable for temperatures up to 2800 F.

**L.W. Firecrete.** Similar to Standard Firecrete but much lighter in weight, it has unusually low thermal conductivity and low heat storage capacity. Recommended for casting furnace doors of all sizes, furnace bottoms and covers, special shapes and monolithic furnaces where the properties of L.W. Firecrete are important. For temperatures to 2400 F.

**No. 20 Firecrete.** Similar to L.W. Firecrete but lighter in weight. For temperatures to 2000 F.

**3X Firecrete.** Particularly designed for temperature ranges from 2600 to 3000 F. For typical uses such as casting burner blocks, door linings, crucible type furnaces, complete linings and special shapes of all descriptions.

**Chrome Castable.** This refractory is especially adapted for casting bottoms for forging furnaces where it effectively resists abrasion and slagging action of iron scale, thus assisting in the production of cleaner forgings. For temperatures to 3200 F.

### Dry, Hydraulic-Setting Cements

**3X Blazecrete.** This cement, for gunning and troweling only, is used in building new and repairing old refractory linings. It adheres readily with a minimum of loss when "shot" in place. Mixed with water at the gun nozzle, 3X Blazecrete is pneumatically projected with great force, resulting in an unusually strong, denser, more homogeneous refractory lining. 3X Blazecrete is equally effective when applied by troweling. It is used for temperatures to 3000 F.

**Standard Blazecrete.** Similar to 3X Blazecrete but recommended for temperatures up to 2400 F.

**L.W. Blazecrete.** Applied the same as 3X and Standard Blazecrete but much lighter in weight. Temp to 2000 F.

### Ready-Mixed, Air-Setting Cements (Mortars)

**Blakite:** A highly refractory, ready-mixed, air-setting cement which possesses high water-retention properties, making it adaptable for laying insulating fire brick. Furnished in a consistency suitable for shallow patching. Blakite can also be used for laying fire-clay, super duty and high alumina refractory brick. It is dark gray in color. Temperature to 3200 F.

**Hellite Refractory Cement.** A general purpose, air-setting cement which is firmly ground, ready-mixed, plastic and pink in color. Used for setting brick with bond or dipped joints, for wash-coating and especially for shallow patching, either hot or cold. Can be used up to 3000 F.

**No. 20 Refractory Cement.** An air-setting cement, gray in color, for use where an extra hard air set is desired. Used up to 2700 F for setting brick with a rubbed joint, and for wash-coating. When desired to use old fire brick as a patching material or monolithic fill, No. 20 is thinned with water and the crushed fire brick added.

**No. 2986 Refractory Cement.** A highly refractory, ready-mixed, air-setting cement which possesses high water-retention properties. It has an extra hard set and is easily workable. Supplied in a consistency desirable for use as a dip and rubbed joint, and for wash coatings. Can be used up to 3200 F.

**No. 1626 Refractory Cement:** A ready-mixed, air-setting cement for laying insulating fire brick. Temperatures to 2600 F.



*Casting a burner block with Firecrete. The refractory cement is as easily placed as ordinary concrete*

### Dry, Heat-Setting Cements (Mortars)

**No. 31 Refractory Cement.** A heat-setting cement for laying fire brick with a bond or cushion joint,  $\frac{1}{8}$ " to  $\frac{3}{16}$ " thick. Similar to No. 32 Cement but with a coarser base. For wash-coating over brickwork which is set up with No. 31, use No. 32. Recommended up to 3100 F.

**No. 32 Refractory Cement.** A general purpose, heat-setting cement. Supplied dry and finely ground. When mixed with water, it develops excellent workability and will not settle in the mixing box. Used for setting brick with brick-to-brick joints and for wash-coating. Temperature limit 3100 F.

**No. 33 Refractory Cement.** A coarse, dry cement for setting brick with a bond joint and patching in zones where extreme temperatures are encountered. Used in patching Detroit Electric Furnaces. For temperatures up to 3300 F.

**No. 30 Refractory Cement.** A coarsely milled, dry cement with a silicon carbide base. Used for patching and lining metallurgical furnaces. Temperature limit, 3000 F.

### Dry, Air-Setting Cements (Mortars)

**No. 26 Refractory Cement.** A coarse, dry cement which takes a medium air set. Used for setting fire brick with a medium bond joint. In special cases also recommended for hot or cold shallow patching, cement gun work and rammed linings. For temperatures to 2900 F.

**No. 34 Refractory Cement.** A dry, chrome ore cement used for setting brick and wash-coating where a neutral refractory is required. Recommended for temperatures up to 3400 F.

### Ramming Mixtures

**No. 28 Ramming Mix.** A high alumina material developed for use as a rammed lining in Ajax Wyatt Induction Furnaces for melting brass and low copper alloys. Rams easily into a dense, homogeneous mass which resists abrasion and attachment of molten metals. For temperatures to 3100 F.

**No. 34 Refractory Cement.** A dry, chrome ore cement used for rammed linings in Ajax Wyatt Induction Furnaces for melting brass and low copper alloys. Temp to 3400 F.

**No. 30 Refractory Cement.** A coarsely milled, dry cement with a silicon carbide base used for rammed linings in special oil-fired furnaces. For temperatures up to 3000 F.

### Light-Weight Aggregates

**JM-2000 L.W. Aggregate.** An alumina silicate material used for insulating or refractory fills; also for making concretes by mixing with calcium aluminate cement. Temp to 2000 F.

**JM-2400 L.W. Aggregate.** Used the same as JM-2000 except the temperature range is to 2400 F.



*Data on Johns-Manville Refractory Products*

Type of Product	Name of Product	Character or Base	Highest working Temp, F	Estimated lb needed per cu ft		Estimated lb to set 1000 Brick	Method of Shipping and Net Weights
Castables	3X Firecrete	High Alumina	3000	130		—	100-lb bags (except 50-lb for No. 20)
	Std. Firecrete	Al. Silicate	2400	110		—	
	H.T. Firecrete	High Alumina	2800	110		—	
	L.W. Firecrete	Al. Silicate	2400	75		—	
	No. 20 Firecrete	Al. Silicate	2000	58		—	
	Chrome Castable	Chrome Ore	3200	180		—	
Cements (dry, hydraulic setting)	3X Blazecrete Std. Blazecrete L.W. Blazecrete	High Alumina Al. Silicate Al. Silicate	3000 2400 2000	Gun.	Trowel	— — —	100-lb bags 100-lb bags 50-lb bags
				155	130		
				120	110		
				76	65		
Cements (Mortars) (ready-mixed air-setting)	Blakite†	High Alumina	3200	—		200-400††	220 lb or smaller containers
	Hellite†	Al. Silicate	3000	—			
	No. 20‡	Silica	2700	—			
	No. 2986†	High Alumina	3200	—			
	No. 1626	Alumina	2600	—			
Cements (Mortars) (dry, heat-setting)	No. 31	Al. Silicate	3100	—		600*	100-lb bags
	No. 32‡	Al. Silicate	3100	—		200-400††	
	No. 33	Kaolin	3300	—		750	
	No. 30	Silicon Carbide	3000	—		800	
Cements (Mortars) (dry, air-setting)	No. 26	Al. Silicate	2900	—		600	100-lb bags
	No. 34	Chrome Ore	3400	200		600	
Ramming Mixtures	No. 28	High Alumina Silicon Carbide Chrome Ore					100-lb bags
	Ramming Mix		3100	160		—	
	No. 30		3000	180		—	
Light Weight Aggregates	No. 34	Chrome Ore	3400	200		—	50-lb bags 65-lb bags
	JM-2000	Al. Silicate	2000	41		—	
	JM-2400	Al. Silicate	2400	50		—	

\* The figure given is for a trowelled joint,  $\frac{1}{4}$ " to  $\frac{3}{16}$ " thick. Without asterisk, the quantities are for brick-to-brick joints. † Approximate quantities required for wash-coating 100 sq ft: 35 lb Blakite with 7 lb water; 35 lb Hellite with 7 lb water; 40 lb No. 20 with 7 lb water; 35 lb No. 2986 with 7 lb water; 50 lb No. 32 with 30 lb water. †† Amount depends upon thickness of joint and porosity of the brick.

**Other J-M Products**

**J-M Insulating Fire Brick.** Used effectively for the building or relining of all sizes and shapes of domestic, oil-burning combustion chambers. They are easily cut to shape and provide unusual savings in fuel costs.



The monolithic refractory linings which protect the stand-pipes in this coke plant were all cast with Firecrete

**Aertite Coating.** A tough rubbery, asphalt-asbestos coating for troweling over the outside of boiler walls where it will not be subjected to temperatures exceeding 250 F. Prevents infiltration of cold air or escape of furnace gases.

**Fireite Asbestos Furnace Cement.** An odorless, ready-mixed paste for sealing joints of domestic furnaces or boilers. Prevents escape of gas, smoke, soot, and, as it adheres firmly to clean metal, can be used to join broken parts. Withstands highest temperature of domestic equipment. It is preferable to let the cement harden 24 hours before firing and cure under slow fire.

**J-M Heat Treating Cement.** A special, ready-mixed, air-setting cement applicable for use in the heat-treating field. The cement is used on high-carbon steel parts, such as axles, power take-off shafts, gears of all descriptions, etc., to prevent carbon penetration or carbonization during heat-treating procedure.

An application of J-M Heat Treating Cement permits the treated part to remain soft or readily machineable after heating and quenching.

In addition, the cement can be applied to shoulder shafts, keyways and similar parts to prevent their cracking when quenched after heat treatment.

J-M Heat Treating Cement is generally used directly from the container. It does not require thinning and is applied by brush, putty knife or wooden paddle. Parts are cleaned and oil removed before application. For temperatures to 2500 F.



## Firecrete Castable Refractories



*Because of its inherent advantages, a monolithic furnace door lining is a desirable construction for both new and old equipment. This door (19-ft long by 11-ft high in center) is lined with L.W. Firecrete, 9" thick. L.W. Firecrete has 50 percent lower heat-storage capacity and  $\frac{1}{2}$  the weight of fire brick*

Unusual savings in the cost of installation, maintenance and operation are responsible for the rapidly increasing use of Firecrete® in all types of industrial and manufacturing plants.

The adaptability of Firecrete® makes possible the easy construction of monolithic furnaces, linings, covers, etc., which otherwise would require the use of special shapes or the laborious work of cutting and fitting brick, with consequent high installation costs. Firecrete can be handled as easily as concrete.

Maintenance is facilitated by casting in place or pre-casting. A small stock of Firecrete eliminates the expense and inconvenience of carrying a wide assortment of special shapes.

Whether new furnace designs or repairs are involved, costly delays in operation can be avoided by Firecrete which makes possible the casting and use of any desired shape or shapes within 24 hours.

To meet the bulk of service requirements, Firecrete

is compounded in five different types: 3X, High Temperature, Standard, Light Weight and No. 20. Each cement hardens rapidly, has no drying shrinkage, negligible firing shrinkage and is highly resistant to spalling. For special conditions, it is possible to use the different types of Firecrete in combination to advantage.

Firecrete is used extensively for furnace door linings, burner rings, baffle tile, header protector tile, pipe linings, furnace bottoms, small monolithic furnaces, and special shapes of all descriptions. The type or types of Firecrete used depends upon the particular service requirement involved.

The descriptions and physical characteristics outlined in the following paragraphs aid in choosing the Firecrete to meet specific conditions.

### 3X Firecrete

3X Firecrete, for temperatures to 3000 F, provides a 200-degree margin of safety over H.T. Firecrete. It is designed for use in industrial furnaces where soaking



temperatures of 3000 F are encountered. 3X Firecrete is composed of high alumina materials which have been calcined at elevated temperatures. It should not be applied less than 2" thick.

### High Temperature Firecrete

This castable refractory is similar in properties and uses to Standard Firecrete but is recommended for temperatures up to 2800 F. H.T. Firecrete provides a 400-F margin of safety over Standard and is frequently used in industrial furnaces where the temperature is not particularly constant and might occasionally rise above the 2400 F limit of Standard Firecrete. H.T. is made of selected, highly-refractory, calcined material. The texture requires that the material be used at a thickness not less than 2".

### Standard Firecrete

Standard Firecrete, for temperatures to 2400 F, is the most generally applicable type of Firecrete. It is composed principally of selected, gradated material which has been calcined at high temperatures. Because of its texture, Standard Firecrete can be used for refractory linings or shapes as thin as 1".

### Light Weight Firecrete

Light Weight Firecrete, for temperatures to 2400 F, possesses qualities which also put it in the class of an insulating refractory concrete. One of its chief applications is for lining furnace doors, though it can be used for the same purposes as the other types of Firecrete where its characteristics meet the requirements of furnace conditions.

Light Weight Firecrete is four times as effective as fire brick in retarding heat flow yet is half the weight. In place, it weighs approximately 75 lb per cu ft as against 125 to 130 lb for fire brick. Since the specific heats of these two materials are approximately equal, the heat storage capacities (weight x specific heat x temperature rise) are directly proportionate to the weight. Consequently, Light Weight Firecrete has 50 percent lower heat-storage capacity than fire brick.

Because of its low heat-storage capacity, this product is particularly recommended for use in intermittently operated furnaces, although its low thermal conductivity also makes its use advantageous in continuous operation. On intermittent furnaces, a great quantity of heat is wasted in heating heavy fire brick. Much heat is

lost when the furnace is shut down and cools. L.W. Firecrete saves 50 percent of this heat.

L.W. Firecrete has remarkable resistance to spalling. In fact, under accepted laboratory and service tests, it is superior to the majority of insulating fire brick now available. It will withstand direct exposure to flame temperatures, but is not recommended for use where it will contact molten metals or highly abrasive materials. L.W. should not be applied less than 1½" thick.

### No. 20 Firecrete

No. 20 Firecrete is similar to L.W. Firecrete but lighter in weight. For temperatures to 2000 F, No. 20 Firecrete is more economical than L.W.

### Properties of Firecrete

Description of Property	Firecrete				
	3X	H.T.	Std.	L.W.	No.20
<b>Highest Recommended Service Temp, F</b>	3000	2800	2400	2400	2000
<b>Pyrometric Cone Equivalent, F</b>					
PCE 33.....	3173	—	—	—	—
PCE 30.....	—	3002	—	—	—
PCE 16.....	—	—	2669	—	—
PCE 15.....	—	—	—	2615	—
PCE 14.....	—	—	—	—	2552
<b>Weight, lb per cu ft,</b>					
As Placed .....	148	131	130	109	96
Oven Dried, 220 F .....	134	113	116	80	62
After 5 hours firing at 1750 F .....	130	110	110	75	58
<b>Crushing Strengths, psi</b>					
After 5-Hr Firing At:					
Oven Dried, 220 F .....	1670	700	1310	630	220
1200 F .....	1065	560	1190	595	210
1750 F .....	775	300	780	490	220
2000 F .....	—	—	—	—	320
2200 F .....	715	580	1190	690	—
2400 F .....	1150	1500	2130	1690	—
<b>Linear Change, percent</b>					
After 5-Hr Firing At:					
1200 F .....	-0.2	0	0	-0.2	-0.2
1750 F .....	-0.2	0	-0.2	-0.3	-0.4
2000 F .....	—	—	—	—	-0.6
2200 F .....	-0.2	+0.3	-0.6	-0.5	—
2400 F .....	-0.4	+1.6	+1.6	+0.3	—
2800 F .....	-0.7	-1.1	—	—	—
3000 F .....	-0.7	—	—	—	—
<b>Thermal Conductivity</b> (Btu in./sq ft/F/hr)					
At Mean Temp:					
800 F .....	—	3.50	3.50	1.99	1.50
1000 F .....	4.40	3.68	3.68	2.09	1.59
1200 F .....	4.60	3.85	3.85	2.21	1.68
1400 F .....	4.80	4.03	4.03	2.36	1.77
1600 F .....	5.00	4.20	4.20	2.56	1.86
1800 F .....	5.20	—	—	2.82	1.95
2000 F .....	5.40	—	—	—	—



### Application of Firecrete

The following directions are general in scope. Complete instructions accompany each individual refractory product.

Type of Firecrete	Water Needed for Casting			Dry Material*, lb per cu ft
	Percent by weight	Pounds per 100 lb	Quarts per 100 lb	
3X	12-15	12-15	6-7.5	130
H.T.	18-21	18-21	9-10.5	110
Standard	18-21	18-21	9-10.5	110
L.W.	40-50	40-50	20-25	75
No. 20	62-70	62-70	31-35	58

\* Estimated dry material required per cu ft of construction. No allowance made for waste.

**Storage:** Firecrete should always be stored in a cool, dry place since exposure to moisture will cause the material to set.

**Mixing:** Firecrete hardens rapidly, therefore water should not be added until the job is ready for application of the refractory material. Only clean, fresh water should be used. The amount of water will vary depending upon the size, shape and type of installation. Mix thoroughly after addition of water and adjust to proper percentage. Avoid an excess of water in order to obtain maximum structural strength in the refractory concrete. If cast against a porous material it is necessary to waterproof, or thoroughly wet, the surface to prevent water being taken from the refractory mixture.

**Casting:** Forms for casting shapes can be made of either wood or metal. Wooden forms should be coated with shellac to prevent the absorption of water from the refractory concrete. If necessary, wooden forms can be burned away without damage to the refractory. If more than one shape is to be cast, heavy metal forms are more satisfactory. They should be smooth and coated with oil or grease to permit the easy removal of shapes. The refractory mixture should be "rodded" with a blunt-end tool until all corners are filled and air pockets eliminated.

**Curing and Firing:** Firecrete air-hardens sufficient in six hours to permit the removal of forms if necessary. For linings or large shapes, it is preferable to air cure for 12 hours or longer before firing. In firing, apply heat slowly and without interruption until the temperature is above service-operating conditions.

When Firecrete blocks or special shapes are used in the construction of refractory walls, they should be laid in J-M Hellite Cement.

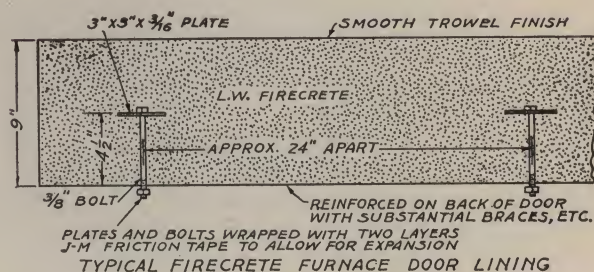


*Firecrete is handled as easily as ordinary concrete*

### Firecrete Furnace Door Linings:

Because of its inherent advantages, a monolithic furnace door lining is a desirable construction for both new and old equipment. By using a castable refractory material, the labor and cost of cutting and fitting brick to the door frame is eliminated. For old doors which have become warped or distorted in operation a monolithic material affords the only practical, economical method of relining. Firecrete, quickly prepared and placed the same as concrete, readily adapts itself to any irregularities in the frame and is ready for service after a few hours of air curing.

Firecrete is suitable for lining doors of practically any design. The method employed for a typical furnace door is outlined in the following paragraphs.



**Preparation of Door Frames:** A door which is less than 4 sq ft in area generally requires no reinforcing to hold the refractory in place. On larger doors, however, it is necessary to provide the refractory with some means of anchorage. Rods with bent ends or bolts with washers and nuts are generally used. Although such anchorage is necessary, best practice sug-



gets that it be kept at a minimum, both in thickness and number.

All bolts or rods, spaced on about 24" centers, should extend through approximately one-half the thickness of the refractory and, where possible, be placed in a staggered construction. The maximum diameter of the bolts or rods generally used is  $\frac{1}{2}$ ". Anchors should not be placed at the corners of the door. On doors subjected to a temperature of less than 200 F, cast-iron bolts and washers may be used. Where service temperatures exceed this limit, special heat-resisting metal anchors should be employed.

The anchor rods or bolts embedded in the Firecrete must be wrapped in paper or, preferably, friction tape to permit expansion of the metal. Neglect of this precaution sometimes results in the cracking and premature failure of a lining.

#### Construction of Monolithic Furnaces:

The simplicity with which monolithic furnace linings can be cast with Firecrete is shown in the following paragraphs and accompanying illustrations.

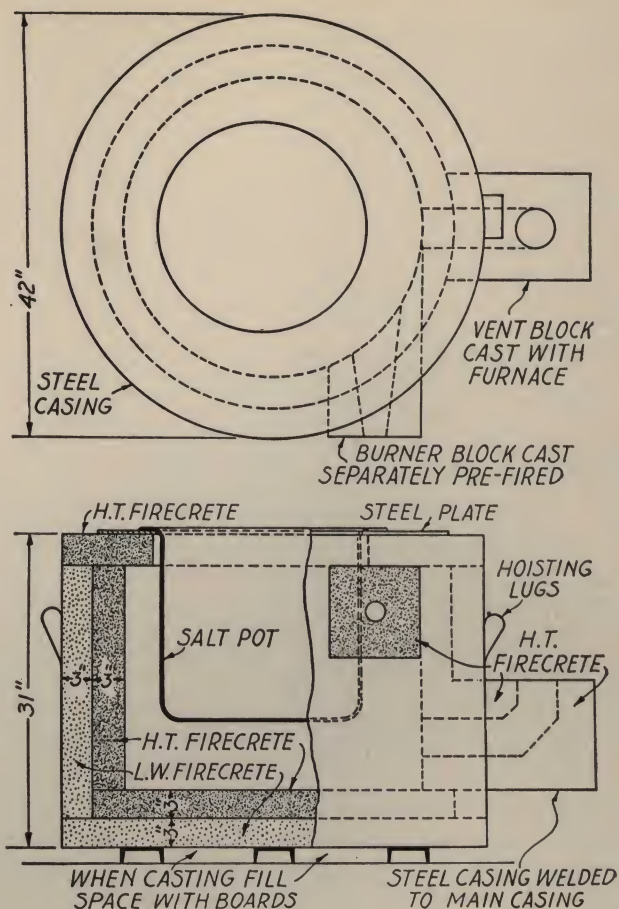
An outside steel casing is first set, and channel irons are welded to the bottom of the form to provide an air space and to prevent burning the floor. L.W. Firecrete is then poured to form a base.

A collapsible inner form is placed inside the outer steel case, and this side-wall area is filled with L.W. Firecrete. When the L.W. Firecrete has partially set, the inner form is replaced with a smaller form and H.T. Firecrete is poured on the bottom and sides.

H.T. Firecrete is used to pour the top of the furnace. A hole is left open in this top, through which melting pots are hung.



Monolithic furnace cast from Firecrete. Note inner collapsible form on left



Plan and cross section of monolithic furnace cast from two types of Firecrete

Firing and vent boxes are also formed with H.T. Firecrete and passed through the L.W. Firecrete outer shell, flush with the inside of the H.T. Firecrete inner lining. Hoisting lugs are placed on the outside of the steel casing.

If temperatures demand it, 3X Firecrete can be used in the same manner as indicated for H.T. Firecrete.

#### Chrome Castable

This material is a dry, hydraulic-setting refractory with a chrome ore base. It is designed for use in forging and heat-treating furnaces where it resists the action of iron scale. A neutral material, Chrome Castable provides a slag-resistant base for billets. It is recommended for temperatures up to 3200 F.

Chrome Castable is poured in place like ordinary concrete. The weight of the billets and size of the furnace determine the thickness of the lining. One cubic foot of construction requires 180 lb of Chrome Castable.



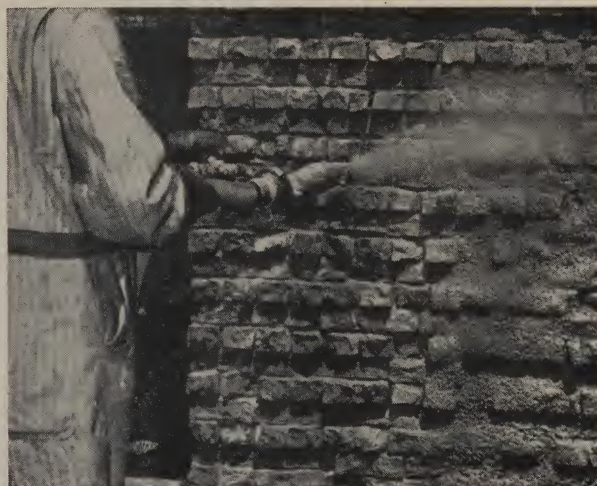
## Blazecrete for Gunning and Troweling

For gunning and slap-troweling applications only, J-M provides three types of monolithic, dry hydraulic-setting refractories: 3X Blazecrete® for service temperatures to 3000 F, Standard Blazecrete to 2400 F, and L.W. Blazecrete to 2000 F. Standard Blazecrete develops higher air-curing and fired strength at temperatures below 2400 F than 3X Blazecrete. L.W. Blazecrete fulfills the requirements for a light-weight, low-heat conductivity refractory which can be readily placed by gunning and troweling.

These three refractories are especially adaptable for gun application in building new and repairing old re-

### Properties of Blazecrete

Description of Property	Blazecrete		
	3X	Std.	L.W.
<b>Highest Recommended Service Temperature, F</b>	3000	2400	2000
<b>Pyrometric Cone Equivalent, F</b>			
PCE 33.....	3173	—	—
PCE 16.....	—	2669	—
PCE 14.....	—	—	2552
<b>Weight, lb per cu ft,</b>			
Slap Troweled:			
As Placed .....	148	132	104
Oven Dried at 220 F .....	133	116	69
After 5-Hr Firing At 1750 F .....	130	110	65
Gunned:			
As Placed .....	158	134	117
Oven Dried at 220 F .....	142	124	76
After 5-Hr Firing At 1750 F .....	140	118	73
<b>Crushing Strengths, psi</b>			
After 5-Hr Firing At:			
Oven Dried, 220 F .....	570	1350	275
1200 F .....	700	1070	338
1750 F .....	790	1130	400
2000 F .....	—	—	461
2200 F .....	1040	1480	—
2400 F .....	2390	2870	—
<b>Linear Change, percent</b>			
After 5-Hr Firing At:			
1200 F .....	0	—0.1	—0.3
1750 F .....	0	—0.4	—0.6
2000 F .....	—	—	—0.8
2200 F .....	—0.2	—0.6	—
2400 F .....	—0.2	—0.4	—
<b>Thermal Conductivity</b>			
(Btu in./sq ft/F/hr)			
At Mean Temp:			
600 F .....	—	—	1.42
800 F .....	—	3.50	1.49
1000 F .....	4.40	3.68	1.55
1200 F .....	4.60	3.85	1.61
1400 F .....	4.80	4.03	1.67
1600 F .....	5.00	4.20	1.74
1800 F .....	5.20	—	1.80
2000 F .....	5.40	—	—



*Blazecrete is especially adaptable for gun application in building new and repairing old refractory linings*

fractory linings. They adhere readily with a minimum of loss when "shot" in place. Mixed with water at the gun nozzle, Blazecrete is pneumatically projected with great force, resulting in a denser, more homogeneous refractory lining.

Where gunning equipment is not available, Blazecrete is equally effective for heavy patching by troweling, especially where brickwork has eroded deeply. It eliminates the laborious ramming or tamping required with plastics. Since Blazecrete is hydraulic-setting, it is not necessary to prefire the patch.

Both Standard and L.W. Blazecrete can be used to advantage alone in their respective temperature zones or in combination with 3X Blazecrete for gunning and troweling applications on many types of installation. Standard Blazecrete is also used extensively by boiler manufacturers to replace fire-clay tile in wall constructions.

### Refractory Patching

**Gunning:** The standard methods of application as recommended by gun manufacturers should be followed. The amount of water added will vary depending upon the size and type of application. If Blazecrete is "shot" or troweled against a porous material, such as Insulating Fire Brick, it is necessary to waterproof or thoroughly wet the surface to prevent water being taken from the refractory.



**Refractory Patching—Continued**

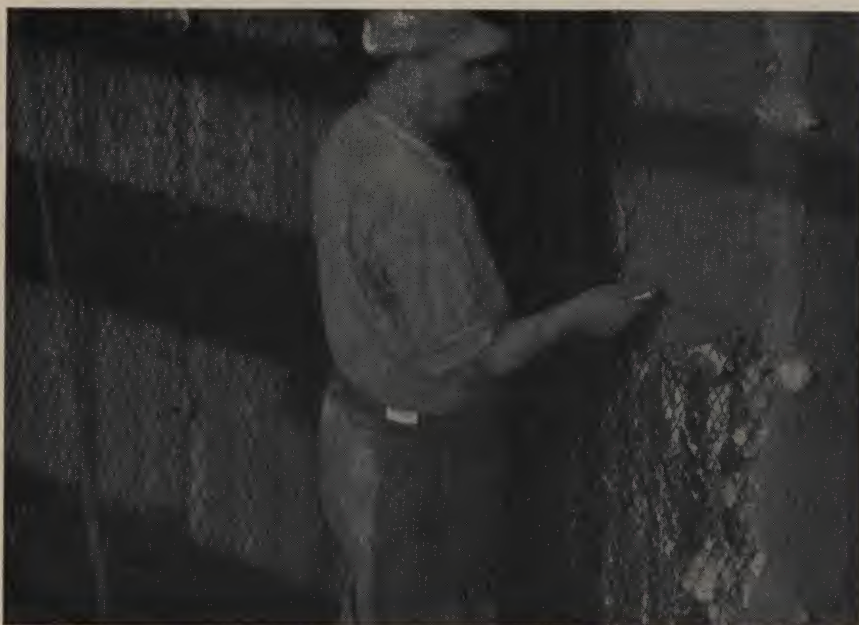
**Troweling:** For heavy patching, the entire surface is cleaned and the necessary keys provided for anchoring. The Blazecrete is thoroughly mixed with clean, fresh water until a stiff consistency is obtained, so that it be readily placed.

**Curing and Firing:** It is preferable to air cure Blazecrete for 12 hours or longer before firing. Heat slowly and, without interruption, bring temperature above service operating conditions. If necessary, shallow Blazecrete patches can be fired immediately.

**Estimated Dry Material\* Required and Mixing Water**

	Blazecrete		
	3X	Std.	L.W.
Dry Material Required per			
Cubic Foot of Construction, lb			
Slap Troweled .....	130	110	65
Gunned .....	155	120	76
Mixing Water by Weight, percent. . .	13-16	20	60
Water per 100 lb of Dry Material, qt	6.5-8	10	30

\* No allowance made for waste.



*Slap-troweling L.W. Blazecrete  
to the water-wall tubes in an  
industrial boiler*



## Applying J-M Refractory Cements

### Refractory Patching

#### *Using Blazecrete:*

3X, Standard and L.W. Blazecrete for heavy patching with gun or trowel are described on a separate data sheet.

#### *Using Hellite Refractory Cement:*

J-M Hellite Refractory Cement is particularly adapted for hot or cold shallow patching. It is supplied in the right consistency for application to the brickwork by means of a long-handled paddle or trowel. The adhering qualities are excellent and a firm vitrified patch results.

#### *Using No. 33 Super-Refractory Cement:*

No. 33 is extremely resistive to the cutting action of oil flame and slag. It should be used only on old furnace walls that have been thoroughly cleansed of slag or cinder incrustation. Any glazed or smooth surface must be chipped away and well scarified before the cement is applied.

No. 33 should be thoroughly mixed with water to a dense mortar consistency and the mixture tempered by standing over-night, covered by wet bags. The cement should be applied with a trowel to a thickness of from  $\frac{1}{4}$ " to  $\frac{1}{2}$ " depending upon the condition of the wall.

### Cements (Mortars) for Laying Brick

The purpose of J-M Refractory Cement in laying fire brick is to bond together many relatively small units into a stable, strong and gas-tight structure. The nature of the cement or mortar used and the manner applied largely determine the strength and efficiency of the refractory masonry.

Use of the proper mortar for the particular condition involved assures correct bonding, protection of joints against slag, resistance against passage of gases, and reduction in spalling difficulties.

To fulfill the many different service requirements, J-M provides several different types of mortars or cements which are classified under "Ready-Mixed, Air-Setting" and "Dry, Heat-Setting."

**Ready-Mixed, Air-Setting Cements (Mortars):** The cements in this classification, No. 20, Hellite and No. 2986, are furnished in consistencies which are retained even though kept in storage for long periods. Each of these three mortars can be thinned with water to suit the porosity of the brick to be set. Full directions are furnished with each cement shipment.



*Setting fire brick with J-M Refractory Cement assures a tight, strong, well-protected refractory wall*

To obtain maximum workability, the mortars should be thoroughly mixed before using. If a thinner consistency is desired, small quantities of water are slowly added—re-mixing thoroughly after each addition until desired consistency is obtained. An excess of water should be avoided.

**Dry, Heat-Setting Cements (Mortars):** When preparing the No. 31, No. 32, No. 30 and No. 33 cements, water is mixed with the cement to provide the proper consistency. Clean, fresh water is required; the quantity depending upon the porosity of the brick which can best be found by trial. The mortar should be thoroughly mixed and free from lumps. Maximum workability is obtained by allowing the mortar to "temper" after mixture with water. Long periods of tempering will not cause deterioration.

### Wash-Coating Brick

**Using Hellite, No. 20, 32 and 2986:** The setting is thoroughly cleaned and the cement mixed with sufficient water to bring it to a thin grout consistency. The mixture is applied to the face of the brickwork with a stiff brush or broom, working it well into the cracks and pores in the brick. It is important to apply the mixture thinly in order to prevent flaking.

Where old settings have to be scarified in cleaning, it is necessary to remove thoroughly all dust particles before wash-coating. This can be accomplished by carefully blowing out dust with an air gun or by hosing out the crevices and washing the walls with water.







## Refractory Products in the Gas and Coke Industry



*Using Hellite as a patching material to minimize retort troubles in a gas plant*

The modern gas practice of pushing gas generating apparatus to the limit of its capacity is responsible for the need of greater care in the study and selection of the materials used to construct this equipment. The protection afforded by J-M Refractory Products is being used in hundreds of gas plants throughout the country to keep pace with bad fuel conditions, higher temperatures, higher blast pressures and mechanically operated clinker bars.

### Coal Gas Apparatus

The economical operation of coal gas benches depends to a great extent on maintaining leak-proof recuperator walls, long-lived producers and minimum maintenance to retorts. Bench producers, recuperator settings, arches and front and rear filling walls bonded with J-M No. 31, No. 32 or Hellite Refractory Cement offer the greatest resistance to trouble from expansion and contraction, which is the cause of leaks in recuperator partitions. Leaks in waste gas flues can be effectively controlled and sealed with No. 26 or Hellite.

For producer brickwork to stand up under the erosion of the charge and the destructive action of the clinker removal, it should be protected with No. 31, No. 32 or Hellite. Patching can be accomplished economically with Blazecrete.

### Water Gas Apparatus

Setting the fire brick or tile lining of the generator, carburettor and superheater with J-M No. 26, No. 32 or Hellite Refractory Cement provides a strong wall that is particularly desirable in the generator to withstand the alternate raising and lowering of temperature occasioned by the blow and run, the destructive action of the clinker bar, the erosive action of the blast and the mechanical abrasion of the charge. Spalling is prevented and insulation is protected from the deteriorating action of steam by the same means. Take-offs, hot valves and connections are all subjected to severe service, but stand up for a much longer time if bonded and sealed with No. 26, No. 32 or Hellite.

Hellite, used for either hot or cold patching, effectively restores cracked or damaged brickwork around generator door openings, generator crowns, blast and steam connections, hot valve take-offs, etc. For heavy patching in generators near gate bars, Blazecrete should be used. For shallow patching, some operators have found gunning with No. 26 to be of considerable help in maintaining the generators.

Blocks for water gas generator clean-out doors, cast of Firecrete with metal handles in place, are more economical and convenient than the firebrick that were customarily used to fill up the clean-out door openings.



### By-Product Coke Ovens

Solid, air-tight walls are of great importance in by-product coke ovens to prevent short circuiting of the gases. The right refractory cements protect the brick-work during charging and pushing, and from the erosive action of the gases.

Poured linings of Firecrete for coke oven doors and standpipes are also the means of effecting great savings in a number of plants.

#### Setting Brick and Patching:

Hellite or No. 26 makes a strong bond in the combustion chamber. For patching and pointing up door jambs, standpipes, charging hole brick and for general gas leak sealing with trowels, Hellite is unexcelled. This material was originally developed for such service and possesses exactly the qualities needed.

As it comes from the air-tight container, Hellite is in the proper consistency for trowel patching. It adheres readily to hot surfaces, quickly freeing itself from the trowel or patching tool and forming the lasting, gas-tight joint so much to be desired in coke oven work.

For gun coatings Hellite can be thinned with water. To apply with a dry gun (Cement Gun Co., Allentown, Pa.) the best results are obtained with No. 26, mixed with 50% by weight of finely ground silica flour. This mixture has proved to be particularly adaptable to this type of work.



*The simplicity of pouring standpipe linings with Firecrete has changed the practice of many progressive operators*



*Coke oven doors lined with Firecrete are easier to install and assure a longer life*

#### Door Linings:

By-product coke oven door linings made of Firecrete are easier to install and will last longer than doors built up from special shapes. The Firecrete is poured or tamped into forms about 3 ft in length, sets hydraulically and does not shrink or crack under temperature. It is very resistant to spalling and tar penetration and requires no patching. The same ease of installing Firecrete is notable in the case of standpipe linings where, in the past, plastic fire brick has been generally used.

#### Standpipe Linings:

The procedure for lining standpipes with Firecrete consists in placing the standpipe, by means of a crane, over a paper-wrapped pipe core and pouring the 3" annular space full of Firecrete which has been mixed with water (20% by weight) immediately before application. During the filling operation, a long stick is used to rod the material and prevent air pockets.

After the Firecrete has set for a few hours, the crane is used to lift the standpipe and lining free from the core. The material is allowed to set for 48 hours more and then placed in service.



## J-M Refractories for Domestic Heating Equipment



*The building of oil-burner combustion chambers, regardless of their shape, is a comparatively simple job with light weight, easily cut J-M Insulating Fire Brick*

Johns-Manville Products for domestic heating equipment have effected important savings on thousands of jobs involving the manufacture, conversion and servicing of all types of oil-burner and stoker installations. These J-M products are: Insulating Fire Brick, No. 1626 Cement, Dobfill, Firecrete, and Fireite Cement.

### Insulating Fire Brick

J-M Insulating Fire Brick effects fuel savings up to 10 percent according to accurate laboratory tests and actual installations. In these tests, domestic oil burners with combustion chambers built of J-M Insulating Fire Brick were tested for fuel consumption against identical units equipped with dense fire clay brick. The low heat capacity and high insulating value of insulating fire brick saves fuel by bringing the combustion chamber up to useful operating temperature in faster time.

Other important, advantageous factors are: higher temperature in the combustion chamber retards the formation of soot, smoke, and odor; quieter burner operation owing to the sound-deadening qualities of the insulating fire brick; and the faster cooling action checks the formation of carbon on burner tips.

**Types of Insulating Fire Brick:** The three types of J-M brick used for domestic fireboxes are JM-20 for use to 2000 F, JM-23 for use to 2300 F, and JM-26 for use to 2600 F. However, JM-26 brick are often adopted because their higher temperature limit and added strength permits a wider range of application. For industrial oil-burner installations, JM-28 and JM-3000 Insulating Fire Brick are available.

**Sizes, Shapes and Weights:** J-M Insulating Fire Brick are furnished in standard fire brick size, 9" x 4½" x 2½". They are packed in cartons containing twenty 9" straight brick. Special shapes are also available on request.

The weights are 2.1 lb. per brick for JM-20, 2.5 lb. for JM-23, and 2.8 lb. for JM-26.

**Accessories:** JM-1626 Cement, a ready-mixed, air setting cement must be used for bonding or laying the Insulating Fire Brick. The amount required is 200 lb. of cement for 1000 Brick. The cement is furnished ready-mixed for immediate use in 10, 20, 100, and 200-lb containers.

For back-fill around the firebox, J-M Dobfill is recommended. This light weight, asbestos material





*The low heat capacity and high insulating value of J-M Insulating Fire Brick saves fuel*

will not expand or corrode the furnace. When mixed with water it also serves as a surface finishing material. It is supplied in 50-lb bags and weighs approximately 20 lb per cu ft.

**Installation:** The construction specifications as recommended by the burner manufacturer for size and shape of firebox should be followed.

The brick are easily cut with a hack saw to form any shape chamber—round, square, oval, pear, etc. Since the insulating fire brick weigh only one quarter as much as dense fire brick, they are easy to handle. For bonding, the brick are dipped into the No. 1626 bonding cement and “rubbed” into place.

### Standard Firecrete

J-M Standard Firecrete is a highly efficient dry refractory which, when mixed with water, can be cast or poured like concrete. It does not shrink, crack or



*A highly refractory hearth for a stoker can be formed merely by pouring and troweling Firecrete around retort and dead plates*

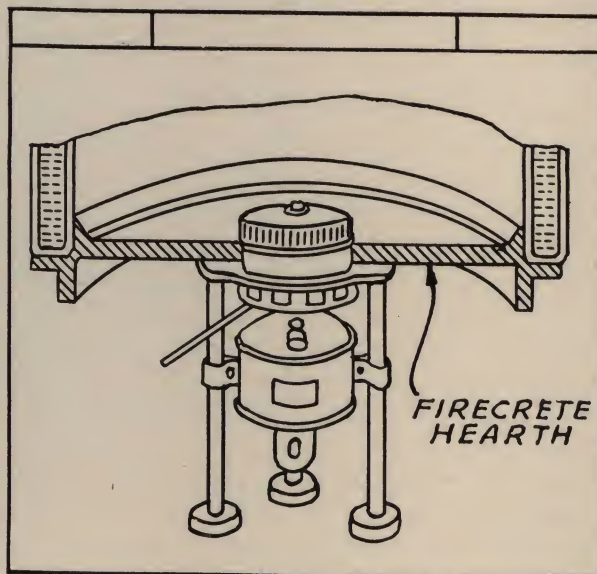
disintegrate under alternate heating and cooling and resists temperatures up to 2400 F. It is especially useful for building hearths in rotary oil burners, embedding dead plates and making entrance boxes on doors of domestic stokers.

Air-setting, Standard Firecrete hardens without the application of heat. Summer installations, therefore, need not be fired until the heating season starts. Detailed mixing and application directions are supplied with each 100 lb bag. A summary of these directions is also given on the data sheets entitled “Firecrete Castable Refractories.”

### Fireite Asbestos Furnace Cement

Efficient and economical operation of domestic heating equipment depends on all joints being sealed against gas leakage and air infiltration. In the installation of such equipment, an open joint can spoil an otherwise good job and result in an expensive service call and annoyance to the owner of the furnace.

J-M Fireite, an easily worked, ready-mixed cement, is recommended for sealing clean-out doors, flue pipes and other furnace parts. It is air-setting, and adheres firmly, without the application of heat, to castings, sheet metal or any other clean surfaces. Fireite is also used with rotary oil burners for bonding tile and as a sealing cement in the pan. Shipped in 1, 2, 3, 4, 5, 10, 15, 35, 50, 100, 220, 500 and 850-lb containers.



*Firecrete for hearths of rotary oil burners assures long life and low maintenance*



## Aertite Coating

Infiltration of cold air through boiler wall cracks is often the cause of a number of furnace troubles. It not only impairs combustion and reduces temperatures, but shortens the life of the refractory lining as well by increasing internal strains of the wall. It also contributes to spalling, since the cold air causes greater temperature differential between the inner and outer surfaces of the refractory.

Where the temperature of the wall does not exceed 250 F, infiltration can be prevented by applying Aertite® Coating, a tough, rubbery, asphaltic-asbestos plastic which forms an air-tight blanket around the outside of the boiler wall. Aertite also checks the escape of furnace gases and dust, and can be used in other locations for miscellaneous sealing against the effects of dampness, air and moisture.

### Application of Aertite

Before applying Aertite, the boiler walls should be thoroughly wire-brushed and freed of dust, loose scale or rust. The Aertite should then be troweled on the outside of the boiler wall to a thickness of  $\frac{1}{8}$ ". Thickness of the coating may be increased on an irregularly surfaced wall, bearing in mind, however, that an application over  $\frac{3}{16}$ " thick will sag as does any asphaltic compound so applied. Small openings around doors and all large cracks should be filled with J-M Hellite Cement. During application, a clean trowel dipped in water aids in finishing the surface smoothly.

Aertite is furnished in 25, 50, 150, 300 and 500-lb containers. For a  $\frac{1}{8}$ " coating, from 50 to 80 lb per 100 sq ft of surface are required. Aertite containers should be kept tightly sealed when not in use to prevent Aertite from partially drying. It is recommended that no material be added to Aertite since solvent for uniform addition to partially dried Aertite cannot be properly hand-mixed in the field.

### Painting of Aertite

Aertite's natural black finish may be made more attractive by covering it with aluminum paint. The aluminum paint shall consist of one of the following, or



*A coat of Aertite effectively seals boiler wall cracks and stops the infiltration of cold air. This increases CO<sub>2</sub> content in the back passes and improves heat absorption because of higher gas temperatures*

equal: Ready-Mixed Aluminum Paint of the Flintkote Company; Valdura Asphalt Aluminum Paint made by the American Asphalt Paint Company, Chicago, Ill.; or Bituseal Exterior Aluminum Paint manufactured by the Cheeseman Elliot Company, Brooklyn, N. Y.

The paint shall not be applied, however, before the Aertite has been subjected to service conditions for about 10 days. This allows excess solvents in the coating to dry out thoroughly.

The paint shall be mixed immediately before using and in no case shall more paint be opened than can be used the same day.

The paint shall be applied in two coats, the first of which shall be allowed to stand not less than 24 hours or longer as required to dry thoroughly, before the second coat is applied.

The paint can be applied by brushing, but a spray will give a quicker, and possibly slightly smoother, job than can be obtained by means of a brush. Other colors may be painted over the aluminum if so desired.



## Fireite Asbestos Furnace Cement

Heating equipment cannot operate efficiently unless every joint is sealed—and sealed properly. Whether new equipment is being installed or old equipment repaired, one bad or leaky joint can spoil an otherwise excellent installation.

Fireite® Asbestos Furnace Cement, an asbestos compound developed by Johns-Manville for mounting and repairing joints in stoves, boilers, furnaces, heaters and ranges, provides the convenient, economical way to make joints gas, smoke and soot-tight.

On installations of oil burner and automatically stoked equipment, where complete combustion must be maintained at all times, the use of Fireite is an important safeguard against costly service calls.

Odorless and easy to apply, Fireite adheres firmly to any clean surface. It sets slowly, under either ordinary conditions or heat, and forms a hard, permanent, gas-tight bond which will not crack, crumble or bloat under the highest service temperatures to which the equipment may be subjected. Unused portions keep well on the bench. The cement is supplied ready-for-use as a smooth paste in various sized containers from 1 to 850 lb.

### Application of Fireite

When mounting or setting new equipment, the metal should be thoroughly wire-brushed to remove all paint, iron rust and other foreign matter before applying Fireite. Gasoline should be used to remove grease.

Before mounting, it is preferable to apply a small

quantity of Fireite, diluted with water to the consistency of paint, to all the metal surface of the joint with a brush or wet cloth. This will fill the slight surface defects which are commonly found in castings. The undiluted cement in the original form is then applied directly from the container, preferably with a spatula or putty knife. In all cases the cement must be firmly pressed against the metal.

In assembling heaters or stoves, the entire joint should be filled with Fireite and the section allowed to settle into the cement with its own weight. It should not be twisted or jammed into place as this would tend to displace the cement from its proper location. When the section has settled into place, any cement which squeezes out should be smoothed off before it sets.

It is preferable to allow Fireite to harden for at least 24 hours before starting a fire. The cement will cure more uniformly if a slow fire is carried at first. Rapid initial firing is likely to cause a weak joint with any cement, and should be avoided.

Heating contractors and plumbers have found Fireite to be as successful in repairing and sealing joints on old equipment as it is when installing new units. Because it adheres firmly to any clean surface, it can even be used for joining broken parts. Fireite may also be used to bond refractory shapes in stoves and furnaces.

Fireite is often employed in installing domestic oil burners and stokers, for sealing clean-out doors, flue pipe connections and other furnace parts; and proves efficient for bonding refractory hearth tile.



## Pal-lite and Transite Pallets



*Because of close warpage control, rapid drying rate, ease of handling and other inherent advantages, Pal-lite trays are becoming increasingly important in the ceramic industry*

Production in ceramic plants demands that every phase of the manufacturing process be conducted at top efficiency. Among the exacting requirements essential to most divisions of this specialized industry are the rate of drying and warpage, which are important factors in the treatment of ware preliminary to firing. Both the drying rate and warpage control are closely associated with the type of pallet material used.

For this service, Johns-Manville manufactures two smoothly sanded asbestos sheet materials, similar in many respects but differing from each other sufficiently in physical properties to accommodate a wide range of conditions.

These two asbestos products are Pal-lite and Transite. Pal-lite trays are absorptive but of less strength than Transite which possesses a much lower moisture absorption. Both Pal-lite and Transite are superior for the service intended and have outstanding advantages over other pallet materials such as wood, plaster of paris mixes, glass, slate, metal, etc., when used in the drying

process for special refractory shapes, abrasive wheels, graphite crucibles, large-size wall tile, china ware and many other miscellaneous uses of this nature.

### Pal-lite

Drying operations often require the free passage of moisture from the bottom of the ceramic ware as well as from the sides and top. A large pressed shape placed on the pallet will not dry uniformly and quickly unless the pallet material itself absorbs the necessary amount of moisture.

Pal-lite is especially suited to such applications because, while more absorptive than other pallet materials, including plaster of paris, it will not disintegrate even when subjected to prolonged immersion in water.

Pal-lite consists of selected asbestos fibre with an inorganic binder formed into solid homogeneous sheets which are light in weight and have an unusually slow rate of heat transmission. The physical characteristics



and economy of this pallet material, together with sizes, may be set forth as shown in the following paragraphs.

### Physical Properties:

The following outline summarizes the essential physical properties of Pal-lite:

1. Approximate Density: The density averages about 36 lb. per cu. ft. (3 lb. per bd. ft.).
2. Average Transverse Strength: At temperatures encountered in the ceramic industry—900 lb. per sq. in.
3. Moisture Absorption: The material readily absorbs moisture but will not disintegrate with prolonged immersion in water.
4. Temperature Limit: The recommended temperature limit of Pallite is 500 deg. F.
5. Freezing: Pal-lite should not be subjected to freezing temperatures while in a moist condition.
6. Warping (Accuracy): Pal-lite is much more accurate than ordinary steel plates, plaster of paris, wood, wall board, etc., and is equal in accuracy to new hammered steel plates and average cast-iron plates. A warpage tolerance of not over  $\frac{1}{64}$ " is allowed for plates 24" and less; for 24" and over,  $\frac{1}{64}$ " in 24".

### Sizes:

Pal-lite can be furnished to suit practically any service requirements. Rectangular pieces and discs or ovals of uniform thickness with a fine sanded finish are available in 1" thicknesses in sizes up to 36", cut to dimension at the factory.

### Economy:

The inherent advantages of Pal-lite result in decided economies in comparison to other types of pallet materials as outlined in the following paragraphs:

Wooden pallets on repeated use frequently require re-surfacing to take out the warp which, naturally, reduces the length of their life and makes necessary frequent replacements.

Plaster of paris mixes have to be made on the job which entails the making of forms for moulding. Also, the plaster is subject to chipping, breaks easily and has a very limited life. Although the apparent cost of plaster mixes is low, the labor required for mixing, pouring and making the moulds and the short life makes cost actually high.

Steel or cast-iron plates warp readily, are heavier and necessarily harder to handle and, in some instances, may discolor the ware when fired.

In addition to being light in weight, highly resistant to heat and warpage, non-corroding and possessing suf-

ficient mechanical strength, the Pal-lite material is chemically inert—it will not stain or discolor ware during the drying period.

### Transite Pallets

Transite Pallets are smoothly sanded trays of asbestos and cement, specially compounded and treated. Transite material is stronger than Pal-lite but weighs more and is very low in moisture absorption. Transite Pallets, are, however, relatively light compared to metal trays and are rustless. The density is about 10 lb. per bd. ft. Aside from weight and absorption, the advantageous characteristics of the two asbestos pallet materials are practically identical, including the warpage tolerance of  $\frac{1}{64}$ " per 24".

### Sizes:

Transite Pallets are furnished in the following thicknesses:  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ",  $\frac{7}{8}$ ", 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ ",  $1\frac{3}{4}$ " and 2". Manufacturing tolerances are  $\pm \frac{1}{16}$ " except as to thickness which is  $\pm \frac{1}{32}$ ". The thickness of unit required varies with the necessary area. The edges are rounded with a radius which is equal to thickness of the unit.

### Proper Thickness for Various Size Pallets

Size of Pallet	Thickness	Size of Pallet	Thickness
6" x 6"	$\frac{1}{4}$ "	18" x 24"	$\frac{3}{4}$ "
6" x 12"	$\frac{3}{8}$ "	18" x 30"	$\frac{7}{8}$ "
6" x 18"	$\frac{1}{2}$ "	18" x 36"	1"
6" x 24"	$\frac{3}{4}$ "	18" x 42"	$1\frac{1}{4}$ "
6" x 36"	$1\frac{1}{2}$ "	18" x 48"	$1\frac{1}{2}$ "
6" x 42"	$1\frac{3}{4}$ "	24" x 24"	$\frac{3}{4}$ "
6" x 48"	2"	24" x 30"	$\frac{7}{8}$ "
12" x 12"	$\frac{3}{8}$ "	24" x 36"	1"
12" x 18"	$\frac{1}{2}$ "	24" x 42"	$1\frac{1}{4}$ "
12" x 24"	$\frac{5}{8}$ "	24" x 48"	$1\frac{1}{2}$ "
12" x 30"	$\frac{3}{4}$ "	30" x 24"	$\frac{7}{8}$ "
12" x 36"	1"	30" x 30"	1"
12" x 42"	$1\frac{1}{4}$ "	30" x 36"	$1\frac{1}{4}$ "
12" x 48"	$1\frac{1}{2}$ "	30" x 42"	$1\frac{1}{2}$ "
18" x 12"	$\frac{1}{2}$ "	30" x 48"	$1\frac{3}{4}$ "
18" x 18"	$\frac{5}{8}$ "	—	—

For sizes of units in between those in the above schedule, the next greater thickness should be used. For example, a unit 30" x 34" should be ordered  $1\frac{1}{4}$ " thick. If thinner units are employed, then the deflections may cause difficulties.

Transite pallet stock will not be furnished in large sheets for field cutting because of the impossibility of properly sealing the edges with impregnant when this is done. On special order, discs and ovals will be supplied to suit requirements.











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## Textiles and Fibers (Asbestos)

### *Complete List of Data Sheets Available*

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★Catalog pages



## J-M Asbestos Fiber



*Important preliminary to selection of fiber—the testing and analysis of samples. In the completely equipped J-M research laboratories, fiber experts make daily use of data drawn from Johns-Manville's extensive experience with asbestos and asbestos products*

Users of asbestos are always looking for a source of fiber which will remain uniform year after year. To meet this demand requires enormous fiber resources, regulated production, standardized grading and rigid control of fiber processing. All these facilities are provided by Johns-Manville.

As one of the earliest asbestos pioneers, Johns-Manville has served both as manufacturer and producer of raw fiber. For many decades, J-M asbestos products have been used all over the world. Extensive Johns-Manville mines have supplied the fiber for countless products in all branches of industry.

During the course of this dual service as producer and manufacturer, Johns-Manville has amassed a vast store of data on fiber and its uses. To manufacturers faced with fiber problems of any kind, this information—along with the services of the largest and most completely equipped research laboratories in the industry—is available without obligation. All inquiries are assured of prompt attention.

### Raw Asbestos Fiber

Asbestos fiber is usually divided into two major classes; amphibole or hornblende, and serpentine. While certain types of amphibole—mainly crocidolite and amosite—are used to some extent, by far the largest volume of fiber used commercially is of the serpentine type. The most important member of the serpentine fiber family in chrysotile.

J-M asbestos fiber, of the chrysotile type, is ideally adapted to practically all of the purposes for which asbestos is used. Mined, milled, sampled and tested under strictest supervision, it is as pure and uniform in quality as the most modern mining methods and machinery can assure.

With the exception of the particularly iron-free variety mined at Chrysotile, Arizona, the vast bulk of J-M fiber comes from the Province of Quebec, Canada, where Johns-Manville owns and operates the largest asbestos mine in the world. Worked 24 hours a day—regardless of weather—the entire year





*Twenty-four hours, year-round operation of the world's largest asbestos mine assures an uninterrupted supply of J-M fiber*

through, this mine has produced over 225,000 tons of asbestos in a single year.

Plant equipment at this mine has been so designed that re-routing of operations to produce special grades of fiber is easily and efficiently accomplished. Moreover, closely controlled production methods assure a steady and unchanging supply of the required fiber from year to year. This is of particular advantage to the manufacturer whose needs are filled only by fiber which has been specially treated.

Every precaution is taken to insure cleanliness of fiber produced at J-M mines. At the Canadian mine pit, for example (the mine at the location is of the open pit type; the Arizona mine is underground), all equipment is of steel to prevent particles of wood from mixing with the asbestos. Even the ties for haulage tracks are of metal, and workmen are forbidden to carry matches.

### Grading of Fiber

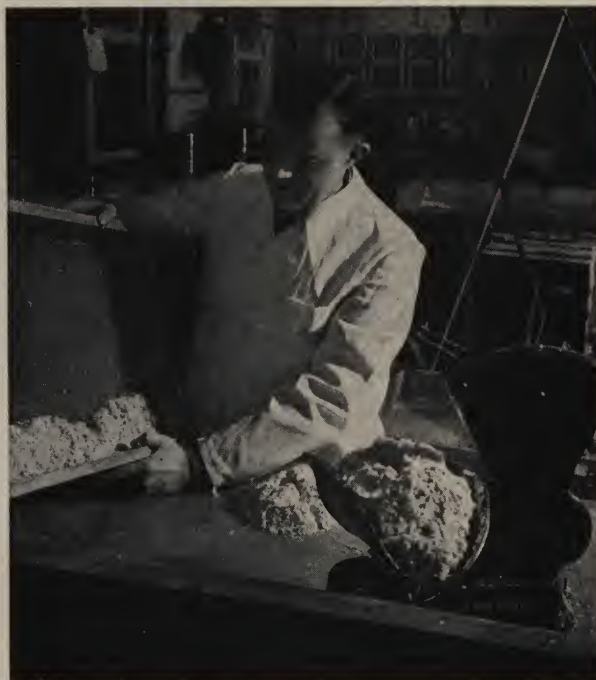
Asbestos fiber generally is graded according to length. There are six major grades: Crudes, spinning, shingle, paper, waste and shorts.

Crude refers to the solid chunks of fiber which have been freed from the rock by hand, as distinguished from the other grades which have been sent to the mill for separation by machine. No. 1 Crude consists of fibers  $\frac{3}{4}$ " long and up; No. 2 Crude includes lengths from  $\frac{3}{8}$ " to  $\frac{3}{4}$ ". The remaining standard grades—milled fibers—are evaluated according to the Quebec Standard Testing Machine.

This machine consists of three screen boxes or trays and a solid-bottomed box known as the pan. These boxes are arranged one above the other and are fastened to a frame which can be vibrated for a specified length of time.

Each box or tray is  $24\frac{1}{2}$ " long,  $14\frac{3}{4}$ " wide and  $3\frac{1}{2}$ " deep. The top or No. 1 tray is fitted with a screen having openings of 0.5" and a wire diameter of 0.105". The No. 2 tray has openings of 0.187" and a wire diameter of .063", while the No. 3 tray has openings of .053" and a wire diameter of 0.047". The lowest tray or pan has a solid bottom.

Tests are conducted by placing 16 ounces of fiber in the No. 1 tray and vibrating the machine for exactly 2 minutes. The amount of fiber remaining in each tray is then weighed to determine under which of the



*Meticulous care in testing makes certain the proper grade. Samples and trial orders best determine results*

major groupings the sample can be classified. Thus, a 16-ounce sample which leaves 4 ounces in Box 1, 8 ounces in Box 2, 3 ounces in Box 3 and 1 ounce in the pan, would be classified 4-8-3-1 or as belonging to Group 3 (spinning fiber). Each major group, however, has a number of subgrades so that the complete grading of this particular sample would be 3K.

The table on the following page shows the designation and minimum screen tests for the more important grades sold in each group.



**Canadian Asbestos Classification**

Group No. 1	Consists basically of crude, $\frac{3}{4}$ " or over in length.		
Group No. 2	Consists basically of crude, $\frac{3}{8}$ " to $\frac{3}{4}$ " in length.		
Group No. 3	Spinning or textile fiber, testing 0-8-6-2 and over.		
3K	Guaranteed minimum test	4.0-7.0-4.0-1.0	
3R	" " "	2.0-8.0-4.0-2.0	
3T	" " "	1.0-9.0-4.0-2.0	
Group No. 4	Shingle fiber, testing below 0-8-6-2 and over 0.0-1.5-9.5-5.0.		
4H	Guaranteed minimum test	0.0-5.0-8.0-3.0	
4K	" " "	0.0-4.0-9.0-3.0	
4M	" " "	0.0-4.0-8.0-4.0	
4T	" " "	0.0-2.0-10.0-4.0	
Group No. 5	Paper fiber, testing below 0.0-1.5-9.5-5.0 and above 0.0-0.0-8.0-8.0.		
5D	Guaranteed minimum test	0.0-0.5-10.5-5.0	
5K	" " "	0.0-0.0-12.0-4.0	
5R	" " "	0.0-0.0-10.0-6.0	
Group No. 6	Waste, Stucco or Plaster fiber, testing below 0.0-0.0-8.0-8.0 and above 0.0-0.0-5.0-11.0.		
6D	Guaranteed minimum test	0.0-0.0-7.0-9.0	
Group No. 7	Refuse or shorts fiber, testing 0.0-0.0-5.0-11.0 and below.		
7D	Guaranteed minimum test	0.0-0.0-5.0-11.0	
7F	" " "	0.0-0.0-4.0-12.0	
7H	" " "	0.0-0.0-3.0-13.0	
7K	" " "	0.0-0.0-2.0-14.0	
7M	" " "	0.0-0.0-1.0-15.0	
7R	" " "	0.0-0.0-0.0-16.0	
7RF	(No test)		
7T	" "		
7TF	" "		
7S	" "		

Although the major groupings of fiber are known as "Spinning," "Shingle," etc., these designations do not accurately classify the uses to which each grade is put. Depending on the product to be made and equipment to be used, a wide variety of grades may be employed for the same purpose. Thus, spinning fiber may be used for moulded brake lining by one producer, while another manufacturer may find a short grade of fiber more adaptable for the same product.

The following paragraphs outline some of the fundamental requirements of fiber used in manufacturing the more common asbestos products. Occasional recommendations, where experience has shown a grade of fiber to be particularly adaptable to the specified purpose, are also included. Since each manufacturer's problem is an individual one, however, these recommendations should be regarded more as suggestions rather than as a basis for final selection.

### ***Desirable Properties of Fiber Used in the Manufacture of Various Asbestos Products***

#### ***Spinning:***

The longer and better grades of fiber are best suited for spinning. Since crudes must first be crushed and carded before use, they should show low losses while being subjected to this treatment. Milled fibers, to be adaptable to spinning, should be soft but strong, and silky in appearance. They should also have sufficient length and should show good workability.

#### ***Insulation:***

For electrical insulation, spinning fibers in the form of roving or yarn are used for winding around the wire. For the sheets and blankets used in boiler and



*The long and short of asbestos fiber—No. 1 (on the left) and No. 7T. Closely regulated production methods insure uniformity of these and intermediate grades, year after year*





*Corrugated pipe insulation is typical of thousands of products in which asbestos is the prime constituent*

pipe insulation, fibers of shorter length are generally adaptable. Lower grades of the short variety are used for insulating blocks and fills.

#### **Portland Cement Products:**

The manufacture of rigid asbestos shingles by the Hatschek or wet process requires a strong, free-filtering fiber, relatively free from fines or impurities. Other asbestos-cement products made by hydraulic filter-press or by a wet machine require fibers that are fairly free from fines and have sufficient length and strength. Fibers in the 4 and 5 groups are generally best suited for these products.

#### **Paper Machine Products:**

Fiber used for this purpose should contain a minimum amount of fines and should be free from unopened fiber to assure smooth texture of the finished product. For maximum operating economies, the fiber should develop high coverage and low machine drop. Grades commonly used range from 7D to 5D. For special high grade paper of the type used in filtration and electro-chemical processes, fibers in the 4 Group are generally employed.

#### **Moulded Brake Lining:**

Fiber that is thoroughly opened, free from grit, rock and fines is best suited for use in moulded brake linings. Depending on the process employed, the fiber may vary in grade from 7D to 4T. Generally, improvement in the finished product is obtained through

use of fibers toward the top of the grade required, since these fibers are longer and freer from fines.

#### **Roofing Cements, Paints and Putties:**

Short, well-opened, grit-free fiber that is uniform in quality and smooth in texture is required for products of this kind. High volume, low density and good absorption are other desirable qualities. Generally, Group 7 fibers or shorts are used.

#### **Floorings:**

Very short fibers are usually employed in the manufacture of products belonging to this classification. The fibers should be relatively free from dust, should show good workability with the binder, and should be free from rock particles and unopened bundles of fiber. Grades 7M, 7R and 7T are generally used.

#### **Moulded Plastics:**

Fiber used for moulded plastics should be well opened, light in weight and should have a minimum amount of grit. It should also show proper particle size distribution to fit the individual manufacturing conditions. Fiber length is important from the standpoint of high impact strength, good absorption and ease of covering by the binder. Asbestos floats are generally used in conjunction with longer fiber.

#### **Insulating Cements:**

Desirable characteristics of fibers used for this purpose are high dry covering capacity, low wet and dry volume shrinkage, resistance to compression and abrasion, low volume of shrinkage at elevated temperature, high reclaim value and good surface appearance. Grades 7M and 7R are commonly employed. For cements in which fiber forms only a part of the ingredients, use longer grades like 6D, 5R and 4M.

#### **Filtration:**

An iron-free, well-opened, free-filtering fiber is required in the manufacture of filter pads used for filtering chemicals, beers, wines, fruit juices, drugs, etc. Shorter grades of fiber generally afford best clarity. Because it is practically iron-free, Arizona fiber No. A-47 is generally used for this purpose.

#### **Special Uses:**

Processed fiber\* for special uses is available as indicated in the footnote below. Samples and specifications furnished on request. All are Canadian fibers except where noted otherwise.

\* Processed fiber for special uses: No. A-47 (Arizona) and 201-A in 50-lb bags. No. 208, 208-I and 211 in 80 lb bags; and No. 296 in 100-lb bags.



## J-M Asbestos Safety Clothing

Johns-Manville Asbestos Safety Clothing is made of closely woven Asbestos Cloth shaped into garments to provide safety for industrial workers. The clothing is light in weight, pliable, and provides resistance to chemicals as well as fire. This J-M textile product is also valuable in providing protection to members of services responsible for fighting and making rescues through fires.

Garments manufactured from Asbestos Safety Clothing include Mittens, Gloves, Aprons, Leggings, Finger and Thumb Cots, Caps, Helmets, Hats, Jumpers, Gaiters, Overshoes, Arm Protectors and Suits.

**Aprons:** Made with adjustable, rawhide leather neck and back straps, and lined with duck. In sizes 24" by 30", 36" and 48"; 26" by 26" and 42"; 36" by 40" and 48".

**Arm Protectors:** Like an asbestos coat sleeve, in lengths of 18", 20", 24" and 26".

**Caps:** Furnished with peak-style visor, square crown, and lined with duck . . . per hat size.

**Cots (Finger and Thumb):** Furnished plain or lined with fleece in small, medium and large sizes. . . . Medium sizes given below:

Finger and Thumb Cots	Approximate Dimensions, Inches	
	Flat Width	Flat Length
Finger Cots (Plain, Medium)	1 $\frac{3}{8}$ to 1 $\frac{1}{2}$	2 $\frac{3}{4}$ to 3
Finger Cots (Lined, Medium)	1 $\frac{5}{8}$ to 1 $\frac{3}{4}$	2 $\frac{3}{4}$ to 3
Thumb Cots (Plain, Medium)	1 $\frac{5}{8}$ to 1 $\frac{3}{4}$	2 $\frac{1}{4}$ to 2 $\frac{1}{2}$
Thumb Cots (Lined, Medium)	1 $\frac{3}{4}$ to 1 $\frac{7}{8}$	2 $\frac{1}{4}$ to 2 $\frac{1}{2}$

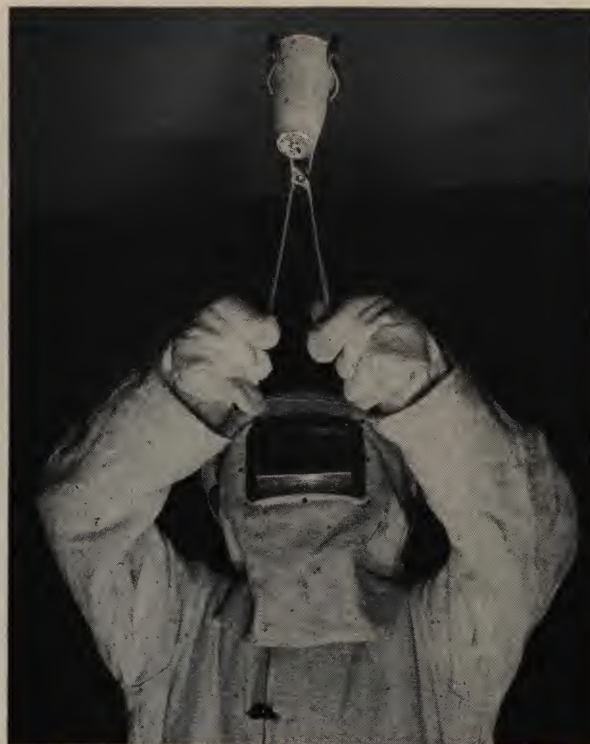
**Gaiters:** For foot and ankle protection. Furnished with leather straps . . . per shoe size.

**Gloves (Style C):** Furnished plain or with palm and thumb reinforced with asbestos cloth (or leather if specified), in lengths of 12", 14" and 16".

**Hats (Southwester Type):** Broad brim provided for protection . . . per hat size.

**Helmets:** Furnished with buckles for attachment to jumpers, side ventilators and heat-resistant glass windows . . . per hat size.

**Jumpers (Coats):** Made with blind seams, riveted clasps and lined with duck . . . per sleeve length.



*Asbestos Safety Clothing is recognized as essential equipment in many industries*

**Leggings:** Furnished with or without foot-protecting flap, and held in place on the leg with spring pressure. Supplied in lengths of 14", 16", 18" and 20".

**Mittens (Style A):** Furnished plain or with palm and thumb reinforced with asbestos cloth (or leather if specified), in lengths of 12", 14" and 16".

**Mittens (Style B):** Same as Style A Mittens except that one finger is free in addition to the thumb.

**Overalls:** Double sewn, reinforced seams, adjustable suspender straps, lined with duck . . . per waist size and inseam length.

**Overshoes:** Furnished with snap clasps and soles reinforced with steel rivets . . . per shoe size.

**Suits (Complete):** Complete with helmet, jumper, overalls, shoes, gloves or mittens.

**Suits (One-Piece):** Furnished one-piece with helmet and gloves.

*(See reverse of this sheet for typical asbestos safety clothing)*



### Typical Asbestos Safety Clothing



*Asbestos Apron*



*One-Piece Asbestos Suit  
with helmet and gloves*



*Asbestos Gloves*



*Asbestos Mittens  
(One-finger style also made)*



*Asbestos Gaiters*



*Asbestos Leggings*



*Asbestos Shoes*



## J-M Asbestos Safety Curtains



*The J-M Asbestos Safety Curtain installed in one of the world's largest theaters.  
Radio City Music Hall, New York, N. Y.*

Protection of the theater audience from the damaging effects of a fire, backstage or in the wings, is a modern necessity. In every large city and most smaller communities, safety curtains are required by law. J-M Asbestos Safety Curtains are thus an essential part of the equipment of every theater and of every auditorium with a stage. Little attempt has been made, however, to standardize the legislation pertaining to safety curtains. Consequently, considerable variation in design and construction of curtains has resulted.

Safety curtains must be custom-made to fit the stage and also to meet the design of barrier and kind of cloth made mandatory by local fire regulations. Therefore, with years of experience in the fabrication of theater curtains and as makers of the asbestos cloth, Johns-Manville is ideally organized to manufacture safety curtains to specification. Only the finished curtain is supplied by the manufacturer—rigging, installation and decoration are done by others.

In most cases, the requirements for the material can be met with one of the standard J-M cloths. Of these, the kinds most generally used in the manufacture of J-M Asbestos Safety Curtains are Styles No. 189, CQ-2810, 1067 $\frac{1}{16}$ " and 444 which, with other styles, are described on data sheet "Braided Asbestos Tubing and Asbestos Cloth." When a cloth of higher asbestos content is required, Style No. UQ-2810, a 95 percent asbestos cloth, is recommended.

### Designs of Curtains

Although various local regulations cover a wide variety of designs, the following are most frequently used.

**Single-Lift Rigid Type:** This curtain is made with a rigid, steel channel framework which usually measures about 4" to 6" front to back. Both sides of the framework are covered with asbestos cloth stretched and secured in place. The curtain is raised and lowered in the channel guides at the sides.

**Double-Lift Rigid Type:** This curtain is constructed similarly to the single-lift rigid type but is made in two sections and arranged so that the lower section rises behind the upper section. When the lower section is alongside the upper section, both continue upward until the height of opening is cleared. This curtain conserves headroom as only one-half the lifting space of a single-lift curtain is required.

**Guide Type:** This curtain is the one most commonly used. It can be furnished with or without a trip pocket. The sketch on the reverse of this page illustrates the guide type and the general arrangement of guides, pockets and trip pocket. Guide type curtains can be made either single or double lift.

**Roll Type:** This curtain should be used only on small stages and where headroom does not permit a curtain of the lift type. The diameter of the smallest curtain when rolled will be about 8". The roll type



curtain is made with horizontal seams to permit smoother rolling. It is not generally recommended because the sides are not held in place when unrolled and it cannot be made smoke retarding.

**Braille Type:** This curtain is generally used where a lift curtain cannot be installed because of limited headroom and where regulations will not permit a rolled curtain. Its construction is similar to the guide type, except that plain, non-metallic cloth, and horizontal seams are always used.

The Braille curtain is arranged so that a number of lift ropes, located vertically across the width of the curtain, pass through ring guides attached to back of curtain in vertical rows. The top edge of curtain is fastened at the top of the stage opening, and when the curtain is raised, it folds up like the bellows of an accordion. The numerous lift ropes are required to make this type asbestos safety curtain fold evenly.

### Smoke Pads

Some fire laws require the attachment of a smoke pad at the bottom of a curtain to form a cushion between the lower edge and the floor, effectively sealing the curtain edge against the leakage of smoke and fire gases under the curtain. Such a pad is made of a roll or folded cushion of hair felt enveloped by asbestos cloth. This covering encloses the bottom pocket of the curtain and the lower pipe batten rests on the hair-felt roll, pressing it against the floor.

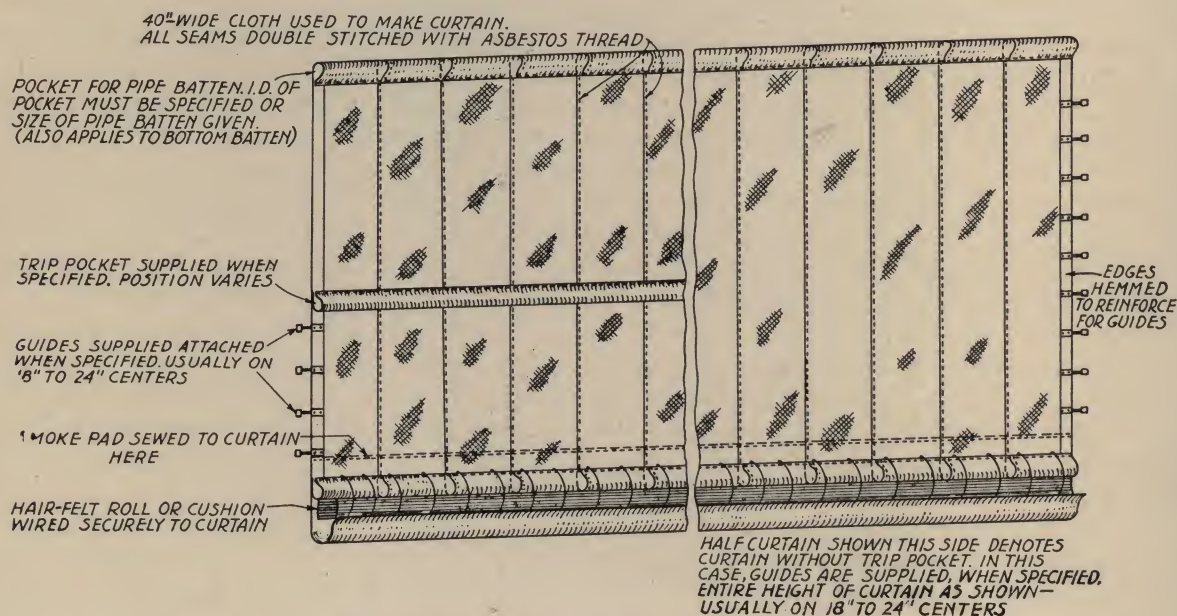
When shipped with a curtain, one side of the smoke pad is stitched to the curtain. The free edge is sewed after the curtain is installed by the contractor.

### Precautions for Quotations and Orders

To assure official acceptance of the curtain after it is installed, the requirements of the asbestos cloth used and the design of the curtain, should be determined before the purchase of material is considered. After the official specifications have been secured, the following data should accompany an order or a request for a quotation on an asbestos curtain.

1. Local regulations or requirements governing the construction or design.
2. Type (plain or wire-inserted), grade and weight of asbestos cloth, or specify J-M style number.
3. Finished size of curtain, designating which dimension is height and width.
4. Size of pockets (or diameter of pipe battens) and location of pockets.
5. Size and location of trip pocket (if required).
6. Type and spacing of guides.
7. Vertical or horizontal seams required. Vertical seams are recommended on all except roll or Braille curtains.
8. On Braille type curtains, spacing of Braille rings both vertically and horizontally must be given.
9. Smoke pad, if required (see drawing); diameter of roll and depth below curtain.

Johns-Manville does not erect asbestos safety curtains, supply the raising and lowering rigging, or do any painting or decorative work on the curtains.



Standard Guide Type of Asbestos Safety Curtain



## J-M Asbestos Roving

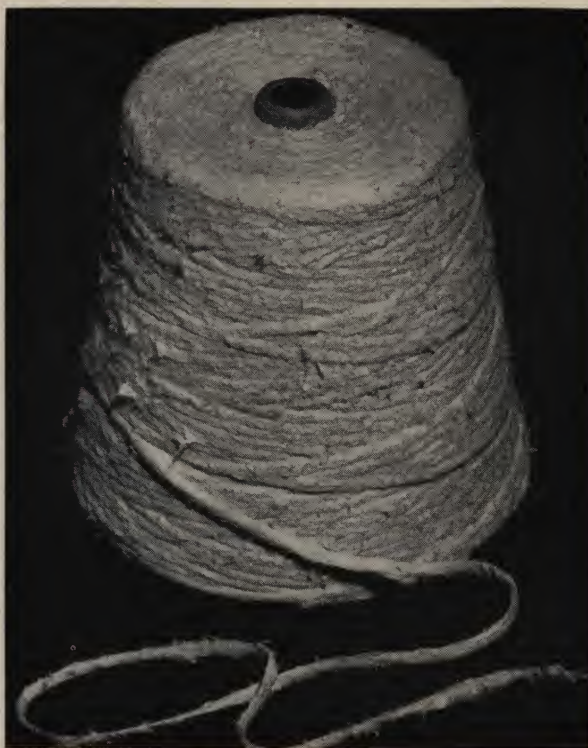
Asbestos Roving is a fire-resistant textile product of carded asbestos fiber and other organic fiber (usually high-grade cotton), mechanically rubbed into a soft, bulky, untwisted strand. It is produced in various degrees of density from a soft, fluffy roving to one that is firmly compacted, in accordance with specific requirements. Soft-rubbed roving gives maximum coverage while hard-rubbed or compacted roving produces more efficient serving-machine operation.

Roving is used extensively by the electrical wire industry as thermal insulation for electrical conductors such as heat-resisting fixture wires, flexible cords or heater cords, cables and numerous electrical heating elements. Strands of Asbestos Roving are wrapped individually by automatic machinery to make a relatively soft, complete sleeve over the wire. The flow of heat is well retarded because the strands are not compacted too densely.

Asbestos Roving is available in two types: **Plain**, consisting of asbestos fiber blended with cotton or other organic fibers, carded and mechanically rubbed, producing a uniform roving of maximum strength; **Reinforced**, consisting of plain Asbestos Roving with a core of cotton yarn or other fiber to give it added tensile strength. Also, Asbestos Roving is manufactured as ferrous or non-ferrous, depending upon the iron content.



*Winding Asbestos Roving on electrical wire for heater cords*



*Cone of 7-Cut Underwriters' Asbestos Roving*

### How Furnished

It is furnished in three ASTM grades—Underwriters', "A" and "AA". Johns-Manville Asbestos Roving meets practically any requirement for this type of asbestos textile. The most widely used grades—Underwriters' and "A"—are available in "cuts" (sizes) from 5 to 14 inclusive.

#### *Asbestos Grades and Service Temperatures\**

Asbestos Grade	Asbestos Content, Percent	Max Service Temp, F
Commercial	75 up to but not including 80	400
Underwriters'	80 " " " " " 85	450
Grade A	85 " " " " " 90	550
Grade AA	90 " " " " " 95	600
Grade AAA	95 " " " " " 99	750
Grade AAAA	99 up to and including 100	900

\* For higher temperatures than those shown, a textile made with metallic (wire-inserted) asbestos yarn is sometimes employed.

**Sizes:** The sizes are 5-cut through 14-cut. The "size" or "cut" number multiplied by 100 gives a result in terms of approximate yards per pound. For example, 7-cut runs approximately 700 yd per lb.



**Packaging:** Tubes and cones, following, of various sizes are supplied to meet individual requirements and are wound with traverse and diameter specified.

**Cones:** Cones are supplied in two standard sizes, large and small: Large—1 $\frac{7}{8}$ " ID at the base and 6 $\frac{3}{4}$ " long, wound 4" OD at the base by 2" OD at the top by 6" traverse; Small—1 $\frac{7}{8}$ " ID at the base and 4 $\frac{1}{2}$ " long, wound 4" OD at the base by 2" OD at top by 4 $\frac{1}{4}$ " traverse.

**Tubes:** Paper Tubes are 3" to 6 $\frac{1}{2}$ " long by  $\frac{5}{8}$ " ID, wound 2 $\frac{3}{4}$ " to 6" traverse by up to 5" OD.

#### Requirements for Yards per Pound of Standard Asbestos Rovings\*

Cut Number of Roving	Nominal Yards per Pound	Permissible Variations	
		In average Yd per Lb	In Yd per Lb of Single 30-Yd Skein
5-cut	500	460 to 540	425 to 575
6-cut	600	552 to 648	510 to 690
7-cut	700	644 to 756	595 to 805
8-cut	800	736 to 864	680 to 920
9-cut	900	828 to 972	765 to 1035
10-cut	1000	920 to 1080	850 to 1150
12-cut	1200	1104 to 1296	1020 to 1380
14-cut	1400	1288 to 1512	1190 to 1610

\* ASTM Designation D-375-52.

#### Standard Classifications for Asbestos Textiles According to Iron Content

ASTM Spec. D-375	Total Iron, Max %	Magnetic Iron, Max %	MILITARY Spec. MIL-I-3053A*	Total Iron, Max %	Magnetic Iron, Max %
Non-Ferrous					
Underwriters' Grade	1.75	0.75	Class 2	2.50	0.75
Grades A and AA	2.00	1.00	Class 4	4.00	2.00
Ferrous	6.00	3.00	Class 6	6.00	4.00

\* Military Spec. MIL-I-3053A formerly Navy Spec. 17-I-29.

NOTE: Ferrous and non-ferrous varieties are used according to the application. Non-ferrous is used where the chief insulation is dependent upon asbestos. Ferrous is used where another insulation element is more predominant.

## J-M Asbestos Lap

Asbestos Lap is a fire-resistant, untwisted, ribbon-like form of asbestos felt. It is made from a number of slivers of carded asbestos fiber and other organic fiber (usually high-grade cotton) laid parallel and rolled mechanically on paper tubes.

Like Asbestos Roving, it is used extensively by the electrical wire and cable industry as an insulation for electrical conductors such as heater cords, fixture wires and cables.

Asbestos Lap is applied to the wire in successive, veil-like webs of asbestos, which are lap-wrapped around the wire, assuring a uniformly thick coverage at all points. In this application, Asbestos Lap provides durable and lasting protection. It completely encloses the wire or cable and contributes to the useful life of the conductor.

A sliver of asbestos fiber as it comes from the carding machine is approximately 1 $\frac{1}{4}$ " wide. Johns-Manville Asbestos Lap is furnished in roll form, on paper tubes, in widths of 3 to 8 slivers. Standard sizes for shipping are 3 $\frac{15}{16}$ ", 6 $\frac{1}{2}$ " and 9 $\frac{3}{4}$ " wide and approximately 14" OD. Weight of the Asbestos Lap is 750 to 3000 grains per linear yard, depending upon the width.

J-M Asbestos Lap is available in two standard ASTM grades—Underwriters' and "AA". Underwriters' grade is the most commonly used. Other grades of Asbestos Lap, higher than Underwriters' and "A", can be fur-



Asbestos Lap is a ribbon-like form of asbestos felt

nished as required. Lap is manufactured as ferrous or non-ferrous, depending upon the iron content.

Lap weight conforms to ASTM Spec. D-1061-52T as to the following permissible percentage variations:

1. In average Grains per Linear Yard of Five Test Specimens . . . . .	5 percent
2. In Grains per Linear Yard of Single Test Specimen . . . . .	10 percent



## J-M Asbestos Yarn



*Section of a Yarn-Spinning Frame and a Tube of 10-Cut, 2-ply, Commercial Asbestos Yarn*

Asbestos Yarns, made from roving which has been mechanically twisted to give it tensile strength, are the principal components of all asbestos textiles produced by the weaving, braiding and forming processes. As such, they impart to the finished product advantages of thermal stability, electrical insulating value, fire protection, durability and other characteristics of the asbestos fibers from which they are spun.

To meet the many and varied requirements of their intended use, asbestos yarns are produced by the asbestos textile industry in a wide range of constructions. The basic styles are Plain (non-metallic), Metallic, and Reinforced.

**Plain:** Plain asbestos yarn is defined as yarn which consists of (1) asbestos fiber or (2) asbestos and other fibers. The "other fibers" (usually cotton or rayon) are introduced in small percentages during processing either to improve the spinning properties of the asbestos fibers or to meet certain specifications in the end product.

**Metallic:** Metallic asbestos yarn, also known as wire-inserted yarn, is plain asbestos yarn with an insert of fine wire. The standard insert is one or more strands of 0.008" brass wire. However, for special purposes, wire of smaller or larger diameter may be used and such metals or alloys as copper, zinc, nickel, nichrome, inconel and monel may also be substituted for the

brass. Metallic asbestos yarns are extensively used in manufacturing asbestos textiles where the end product requires unusually high tensile strength, exceptional resistance to heat or abrasion, or a combination of these properties.

**Reinforced:** Reinforced asbestos yarn is plain asbestos yarn with an insert of yarn made of other fibers, usually cotton or rayon, or a combination of both. Glass filament or nylon may also be used. Reinforced yarns, also referred to as inserted yarns, are particularly adapted to the braiding and weaving processes because of their higher-than-average tensile strength.

These plain, metallic and reinforced asbestos yarns are produced as both single and plied yarns, the latter consisting of a number of strands of single yarns twisted together to form a heavier yarn of greater strength. Asbestos yarns are made in a range of cuts (sizes) and in the following grades.

For special purposes, asbestos yarns are also coated or impregnated with various compounds to increase tensile strength, lay the fibers or impart certain qualities of the compound. These are known as treated or sized yarns.

**Grades:** Asbestos Yarns are made in all standard ASTM grades—Commercial, Underwriters' A, AA, AAA and AAAA.

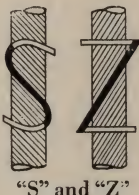


**Asbestos Grades and Service Temperatures\***

Asbestos Grade	Asbestos Content, Percent	Max Service Temp, F
Commercial	75 up to but not including 80	400
Underwriters'	80 " " " " " 85	450
Grade A	85 " " " " " 90	550
Grade AA	90 " " " " " 95	600
Grade AAA	95 " " " " " 99	750
Grade AAAA	99 up to and including 100	900

\* For higher temperatures than those shown, a textile made with metallic (wire-inserted) asbestos yarn is sometimes employed.

**Direction of Twist:** Asbestos Yarns are spun with "S" and "Z" twists. . . . yarn or cord has "S" twist if the spirals conform in the direction of slope to the center section of the letter "S". . . . A yarn or cord has "Z" twist if the spirals conform in the direction of slope to the center portion of the letter "Z".



**Yardage:** To determine the yards per pound for Single-Ply Yarn, multiply the "cut" or "size" by 100. . . . For Multi-Ply Yarns, take the Single-Ply yardage, minus 10 percent, and divide by number of plies. The yardage per pound of metallic asbestos yarn is less than that of plain yarn of the same "cut" in proportion to the weight of the inserted wire.

**Yarn Numbers:** In the asbestos-textile industry, the yarn-numbering system used designates the cut, number of plies, and whether the yarn is plain or metallic. . . . In a four-digit figure, the first two digits indicate the cut, the third digit the number of plies, and the fourth digit the number of metallic strands. If the final digit is a zero, it indicates a plain (non-metallic) yarn. For example, No.1022 is a 10-cut, 2-Ply Metallic Yarn containing two wires; No.1430 is a 14-cut, 3-Ply Plain Yarn. . . . In a three-digit figure, the first digit only in-

dicates the cut. Thus No.810 is an 8-cut Single Plain Yarn.

**Endless Yarn:** Endless or knotless yarn is plied yarn in which splices are made without knots and without change in the yarn diameter.

**Ends-Up:** Ends-Up refers to the number of ends (strands) of yarn wound parallel on a tube or cone.

**Cord Construction:** Asbestos yarn with six or more plies of single yarn.

**Uses:** Typical uses for Asbestos Yarn include the manufacture of asbestos cloth, tape, listing, and tubing; as core and wrapping for electrical resistance wires; packing for flexible metal hose or tubing; wire-wiping in galvanizing plants; and sewing asbestos cloth.

**Packaging and Sizes:** Asbestos Yarns are wound on paper tubes (Universal Winding) of various lengths to meet individual requirements. They are wound with traverse and diameter specified.

The paper tubes are 3" to 6½" long by ⅝" ID, wound 2¾" to 6" traverse by up to any desired OD.

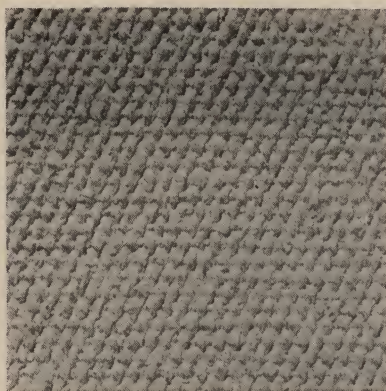
**Requirements for Yards per Lb of Standard Single Asbestos Yarn\***

Cut Number of Yarn	Nominal Yards per Pounds	Permissible Variations	
		In average Yd per Lb	In Yd per Lb of Single 30-Yd Skein
5-cut	500	460 to 540	425 to 575
6-cut	600	552 to 648	510 to 690
7-cut	700	644 to 756	595 to 805
8-cut	800	736 to 864	680 to 920
9-cut	900	828 to 972	765 to 1035
10-cut	1000	920 to 1080	850 to 1150
12-cut	1200	1104 to 1296	1020 to 1380
14-cut	1400	1288 to 1512	1190 to 1610
16-cut	1600	1472 to 1728	1360 to 1840
18-cut	1800	1656 to 1944	1530 to 2070

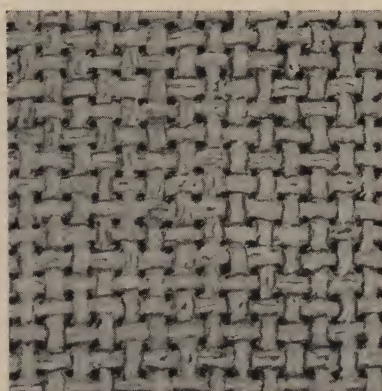
\* ASTM Designation D-299-52T.



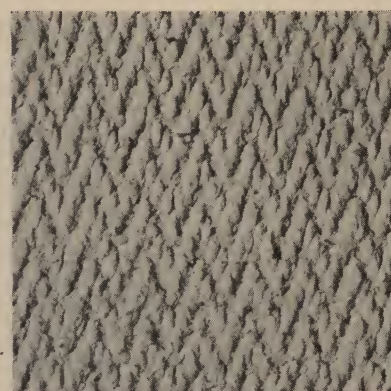
## J-M Asbestos Cloth



*Asbestos Cloth—Style 444*



*Asbestos Cloth—Style DE-808*



*Asbestos Cloth—Style FE-4914*

Asbestos cloth is asbestos yarn woven into a fabric to form a pliable mineral textile with high tensile strength and high resistance to both heat and chemicals. It is produced in many textures, grades, weights and thicknesses to meet the numerous diversified uses of this versatile asbestos-textile product. Textures range from open mesh to lightproof and the choice of weaves includes plain, twill and herringbone. Various styles of cloth are also available, including plain (non-metallic) and metallic and in a variety of thicknesses and weights suitable for every purpose.

**Uses:** Because of its inherent incombustibility and thermal stability, asbestos cloth is extensively used wherever these properties are essential in a fabric. Typical examples are the familiar asbestos curtains of theaters and auditoriums, fire-smothering blankets and flameproof draperies, all of which are made of asbestos cloth. The fire-fighting suits worn by personnel in the oil fields and the military services are another familiar application. Coats, trousers, aprons, shoes, gloves, mittens, leggings and helmets made of asbestos cloth are also used to protect workers in industrial plants.

Asbestos cloths are widely used as facings for the traveling conveyor belts servicing ovens, lehrs and dryers, as covers for ironing boards and laundry machine rolls, as industrial furnace hoods, shields for welding booths, belts for blueprint and mat-drying machines and insulation for diesel-exhaust pipes.

Federal specifications, particularly those of the United States Navy, require pipe insulation to be protected by an outside jacket of asbestos cloth. All maritime specifications, and many industrial and utility power plants also require asbestos cloth to hold the insulation in

place and to serve as a permanent protection and fire-proof jacket over pipe and boiler insulation. Underground and overhead piping, both steam and refrigeration are often protected by a jacket of asbestos cloth.

The dust bags for removing dust, fumes and vapors in mechanical dust-collecting systems are among the more specialized uses of asbestos cloth. Here, conditions of temperature, humidity and corrosion are such that often only bags made of asbestos cloth will satisfactorily meet the requirements of this exacting service. Other specialized applications are in the glass industry, where treated asbestos cloths serve as paddle covers, tray linings and lehr curtains under extremely severe conditions.

In combination with other materials, asbestos cloth provides special advantages resulting from the inorganic mineral fibers of which it is woven. A typical example is in the fabrication of molded and laminated plastics where asbestos fabrics, used as reinforcements, provide increased flexural and impact strength in the finished product.

The metallic asbestos cloths are noted for their superior tensile strength and high resistance to heat and abrasion. These qualities make them virtually indispensable as a base in automotive and industrial friction materials, mechanical packings and gaskets and as an insulation over high-temperature boilers and turbines.

**Grades:** Asbestos cloth is made in the complete range of standard A.S.T.M. grades as follows: Commercial, Underwriters', A, AA, AAA and AAAA. In general, the grades containing the higher percentages of asbestos provide greater thermal stability.



*Approximate Service Temperatures, F*

Commercial grade . . . . .	350 to 400
Underwriters' grade . . . . .	400 to 450
"A" grade . . . . .	450 to 550
"AA" grade . . . . .	550 to 600
"AAA" grade . . . . .	600 to 750
"AAAA" grade . . . . .	750 to 900

**Widths:** Standard cloth widths are 36" and 40" but other widths can be woven for special applications.

**Weights:** The weight of asbestos cloth varies from approximately one to several lb per sq yd, depending on type of weave, grade of yarn used, its cut, ply, whether plain, reinforced or metallic and other factors.

**Standard Packaging:** Asbestos cloth is furnished in rolls of approximately 50 yards.

**Thicknesses:** Single-ply cloths range from approximately 0.030" to 0.100" thick. Fabrics up to  $\frac{5}{16}$ " thick can be woven in multi-ply construction.

*Standard (Natural White) Asbestos Cloths—Specifications*

Commercial Grade (No Wire Insertion)								Commercial Grade (Wire Inserted)								
J-M Style Number	Asb. Tex. Institute equiva- lent style	Weight† per sq yd, lb	Approx thick- ness, in.	Warp yarn*	Filler yarn*	Warp ends per in.	Filler ends per in.	J-M Style Number	Asb. Tex. Institute equiva- lent style	Weight† per sq yd, lb	Approx thick- ness, in.	Warp yarn*	Filler yarn*	Warp ends per in.	Filler ends per in.	Wire
444	36P10	2.25	.070	1020	1020	18	9½	189	44M8	2.75	.070	822	811	14	10	Brass
1067- $\frac{1}{16}$ "	40P10	2.50	.075	1020	1020	20	10	M-32	44M8	2.38	.070	821	811	16	11	Brass
1067- $\frac{1}{32}$ "	30P10	1.87	.058	1420	1420	20	10	1414	32M8	2.00	.050	811	811	14	14	Brass
FE-4914	40H14	2.50	.070	1420	1420	28	14	DS-2807	48M10	3.00	.078	1022	1022	16	7	Brass
DE-808	24P10	1.50	.055	1020	1020	8	8	CS-2807	55M8	3.45	.080	822	822	16	7	Brass
710	34P10	2.13	.062	1020	1020	16	10	CQ-2810	48M8	3.00	.075	822	811	16	10	Brass
6190	30P10	1.87	.055	1020	1010	16	10	DR-3009	56M10	3.50	.080	1022	1021	20	9	Brass
DE-8516	64P10	4.00	.125	1020	1020	25	14	CQ-1610	48M8	3.00	.075	822	811	16	10	Brass
DE-10616	76P10DC	4.90	.135	1020	1020	36	16									
Underwriters' Grade (No Wire Insertion)								"AA" Grade (Wire Inserted)								
GE-3210X	28P16	1.80	.053	1620	1620	24	10	MP-3010	52M10	3.25	.072	1021	1021	20	10	Brass
DE-2909X	37P10	2.33	.065	1020	1020	18	9	00-3010	44M14	2.75	.047	1421	1421	20	10	Brass
DE-3010X	40P10	2.50	.078	1020	1020	20	10									
FE-3010X	29P14	1.87	.056	1420	1420	20	10									
3767	22P10G	1.40	.040	1010	1010	18	9									
"AA" Grade (No Wire Insertion)								"AAA" Grade (Wire Inserted)								
OE-3010	29P14	1.87	.058	1420	1420	20	10	UQ-2711	44M8	2.75	.065	822	811	14	11	Brass
ME-3010	40P10	2.50	.075	1020	1020	20	10	VR-3111	64M10	4.00	.065	1022	1021	22	10	Brass
PE-1215	21P16	1.35	.045	1620	1620	12	15	VS-2909	56M10	3.50	.073	1022	1022	18	9	Monel
ME-2909	36P10	2.33	.065	1020	1020	18	9									
"AAA" Grade (No Wire Insertion)								"AAAA" Grade (With or Without Wire)								
912	38P12	2.40	.065	1220	1220	20	11½	Consult Johns-Manville for currently available styles								
WE-5011	48T12	3.00	.075	1220	1220	30	11									
WE-6912	53T12	3.33	.080	1220	1220	36	12									
VE-2808	34P10	2.13	.060	1020	1020	16	8									
UE-4807	56T8	3.50	.085	820	820	24	7									
WI-4809	62T12	3.88	.085	1230	1230	24	9									
VE-2909	36P10	2.25	.065	1020	1020	18	9									

† Tolerance, plus or minus 5%.

\* First number, "cut"; second number, ply; third number, wire.

*Some Uses of Asbestos Cloth and the J-M Style Numbers Recommended*

Uses	Style Number	Uses	Style Number
<b>Blankets</b>		<b>Filter Cloths</b> . . . . .	WE-6912; WE-5011
Annealing . . . . .	444	<b>Hoods, Forge Furnaces</b> . . . . .	444; CQ-2810
Fire Smothering . . . . .	444	<b>Insulating Covers</b>	
<b>Belts</b>		Glass Conveying . . . . .	444; 912
Blue Printing Machines . . . . .	1067, $\frac{1}{16}$ "; 444	<b>Jackets over Insulation</b>	
<b>Clothing</b> . . . . .	444; 1067, $\frac{1}{16}$ "	Temp. to 350 F . . . . .	444
FE-4914; ME-3010		Temp. above 350 F . . . . .	444; 912
<b>Covering Insulation</b>		<b>Mill Scale Fenders</b> . . . . .	444
Diesel Exhaust Pipes . . . . .	444	<b>Motion Picture</b>	
<b>Curtains</b>		Portable Booths . . . . .	444; 1067, $\frac{1}{16}$ "
Dryers . . . . .	444; CQ-2810	<b>Wrapping</b>	
Glass Lehrs—Welding . . . . .	444; 1067, $\frac{1}{16}$ "	Sheet Glass . . . . .	444; 1067, $\frac{1}{16}$ "
Shields for Workmen, Fire Protection . . . . .	444	Conveyor Rollers . . . . .	444; CQ-2810
<b>Electrolytic Cells</b> . . . . .	WE-5011; WE-6912		
UE-4807			



## J-M Asbestos Tape (or Listing)

J-M Asbestos Tape (or Listing) is a fireproof, flexible tape woven from high grade Asbestos Yarn that will not unravel in service. Because of their excellent electrical and heat insulating qualities as well as their high tensile strength, J-M asbestos woven tapes are used for insulating electrical wires, coils, cables and other electrical conductors; for insulating small steam pipes and bends such as in locomotives; as gasketing and packing material; for binding the wounds of trees after grafting to prevent infections and hasten healing; and as wicking in oil-burning apparatus. The thermal stability of Johns-Manville Asbestos Tape also makes it particularly suitable for use as a conveyor belt for carrying hot materials.

For electrical purposes, thinner tapes in Underwriters' grade are standard. Wire-inserted tapes are used where high-temperature and abrasive conditions are encountered, or where greater strength is required. Large quantities are used in the manufacture of woven brake linings and clutch facings.



*Asbestos Tape (or Listing)*

### J-M Asbestos Tapes (or Listings)—Specifications

Style Number	Thickness, inches	Grade of Tape	Approximate Feet per Pound per inch of width ( $\frac{1}{2}$ " thru 6") given													
			$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$	6
1055 Plain	0.020	Underwriters'	227	133	121	95	73	56	—	—	—	—	—	—	—	—
1064 Plain	0.025	Underwriters'	170	113	88	72	62	49	—	—	—	—	—	—	—	—
1065 Plain	$\frac{1}{32}$	Underwriters'	182	118	93	73	61	52	—	—	—	—	—	—	—	—
1073 Plain	$\frac{1}{32}$	Commercial	135	88	66	51	44	34	—	—	—	—	—	—	—	—
1091 Plain	$\frac{1}{16}$	Commercial	81	55	41	33	29	22	18.2	14.6	12.6	10.9	9.9	9.1	8.2	7.1
1096 Plain	$\frac{1}{16}$	Commercial	74	52	37	29	24	19	15.3	12.7	11.0	9.3	7.8	7.1	6.6	6.2
1091 Wire-Inserted	$\frac{1}{16}$	Commercial	68	43	32	27	21	16	13.6	10.5	9.5	8.2	7.5	6.8	6.3	5.6

Note: Standard length rolls are 150 ft for widths 1" thru 3"; all other widths, 100 ft rolls.

### J-M Asbestos Oil Burner Wicking

J-M Asbestos Oil Burner Wicking is woven from Asbestos Yarn specially selected to give maximum efficiency in this type service. Relatively closely woven, wire-inserted wickings with plain weaves and uniformly straight selvage edges are generally used. Other types with open-mesh weaves, looped edges or with additional heavy longitudinal wires are available to suit specific requirements. The addition of longitudinal wires stiffens the wicking so that it retains the

proper shape when installed circularly on edge in oil-burning elements. The wicking is supplied as indicated in the table following.

#### J-M Asbestos Oil Burner Wicking—Specifications

##### Commercial Grade No. 1092, $\frac{1}{16}$ " Thick

Width,* inches	Feet per Pound	
	Plain Wire Reinforced	With 2 Additional Wires
$\frac{7}{8}$	36	29
$1\frac{3}{8}$	26	20

\* Other widths up to  $1\frac{1}{2}$ " are available.  
Note: Standard length rolls are 150 ft.



## J-M Asbestos Braided Tubing

Johns-Manville Asbestos Tubing is made from selected Asbestos Yarn braided into fireproof, heat-and-chemically-resistant flexible sleeving for insulating electrical wires and cables (to protect them against failure of adjoining cables). It also covers the rods of thermocouples. In the glass industry, it is used as sleeving over tongs to prevent pressure marks on soft, hot glass.

The Asbestos Braided Tubing is available in sizes from  $\frac{1}{64}$ " through  $2\frac{1}{2}$ " inside diameter. Wall thickness is approximately  $\frac{1}{16}$ " thick in sizes up to  $1\frac{1}{2}$ " inside diameter. Asbestos Tubing larger than  $1\frac{1}{2}$ " ID has a wall thickness of approximately  $\frac{3}{32}$ ". All tubing is furnished with plain finish. However, tubing may also be supplied with size finish if desired.

The table following gives data relative to the various sizes, weights, etc., of the standard styles of J-M Asbestos Tubing. Besides these standard styles, Johns-Manville can furnish tubing of other grades up to "AAA", with wall thicknesses less than  $\frac{1}{16}$ ", and with wire insertions if desired.

Because braided asbestos tubings are so flexible, the diameters given in the table are for tubings expanded



Asbestos Braided Tubing

to normal size. The width given for  $\frac{3}{4}$ " ID and larger can be varied as much as  $\frac{1}{4}$ " narrower or wider by manipulation.

J-M Asbestos Braided Tubing—Dimensional Data

	Commercial Grade: Ferrous—Non-Metallic																							
	Wall Thickness: Up to 1½" ID, approx. 1/16"; Above 1½" ID, approx. 3/32"																							
I.D. inches	⅛₄	⅛₂	⅛₁₆	⅛₈	⅜₁₆	⅛₄	⅝₈	⅛₂	⅝₁₆	⅝₈	⅜₄	⅞₈	⅞₁₆	1⅜₁₆	1⅜₈	1½₂	1⅝₁₆	1⅝₈	2	2⅛₈	2¼₄	2⅝₈	2½₂	
O.D. inches	⅛₈	⅜₃₂	⅜₁₆	⅛₄	⅝₁₆	⅝₈	⅛₂	⅝₈	1⅛₁₆	⅜₄	⅞₈	1	1¼₄	1½₂	1⅝₈	1⅝₁₆	1⅝₈	2⅛₁₆	2⅝₈	2⅝₁₆	2⅝₈	2⅝₈	2⅝₁₆	
Approx. flat width, inches	R'nd	R'nd	R'nd	⅝₁₆	⅝₈	⅛₂	⅝₈	⅜₄	⅞₈	1	1⅛₈	1¼₄	1½₂	1⅜₄	1⅞₈	2⅛₈	2¼₄	2½₂	2⅝₈	2⅝₄	3	3¼₄	3⅝₈	
Approx. feet per lb	175	100	85	65	50	45	23	20	16	15	14	12	10	9	8	7	6	5	4	3¾	3½	3¼	3⅛	
For use over B&S Wire Gauge No.	17	10	8	5	4	2	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	







